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The Manufacture of Rubber-bond Grinding Wheels

By Ellsworth Sheldon

New England Editor, *American Machinist*

Preparation of the rubber—Compounding, mixing and calendering — Thin wheels cut from sheets — Thicker wheels made from several thin ones pressed together hydraulically

CONTEMPORANEOUSLY with the evolution of the grinding machine as a factor in the production of tools and machine parts has come the development of the grinding wheel as a cutting medium. Wherever the conditions of its employment have been favorable to its use the grinding wheel has taken its place as a means of removing surplus material, and wherever the material to be removed is too hard for the cut to be undertaken by tools of steel the wheel has extended the possibilities of shaping metal.

Grinding as it was practiced before the invention of the modern grinding machine was an operation more in the nature of polishing off, or wearing away, the extra metal by a slow process of attrition than of cutting it off in appreciable chips, and it is to this condition that we owe the term "abrasive" as it still persists in the common designation of grinding wheels and materials. We would not think of calling the "diamond-poin'" or "hog-nosed" tool of the lathe or planer, getting under the surface of the material upon which it is operating and shearing off chips and shavings of metal of perhaps a quarter-inch or more in section, an "abrading" tool; yet the hundreds of thousands of cutting points of the grinding wheel are doing the same work in the same way, only in much smaller proportion and at a correspondingly faster rate.

As the modern grinding machine would exist to no purpose without the modern grinding wheel, so the latter would not have come into existence but for the necessity for more efficient cutting properties imposed by the possibilities of the machine. Each was dependent upon the other, and as the versatile production machine grew out of the crude mechanisms by means of which the process of grinding was then applied, the modern abrasive wheel was evolved from the solid "rubber wheels" and "emery wheels" of fifty years ago.

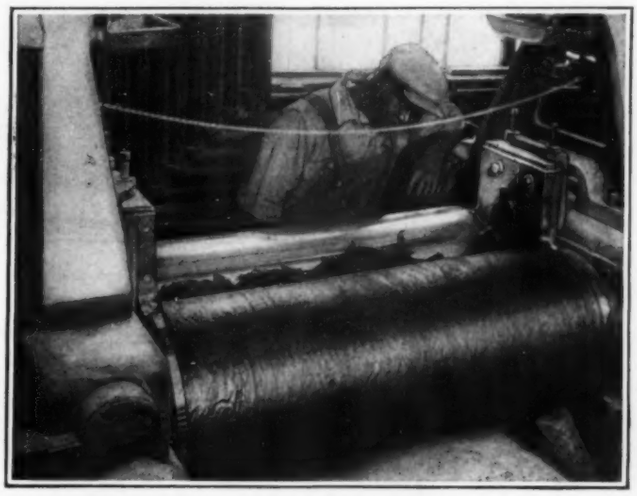


Fig. 1—Conditioning the rubber

Of the several classes of grinding wheels in existence during the early days of grinding machinery the rubber-bond wheel was, perhaps, the one that gave least promise of development as an efficient cutting medium, and the clay-bond, or, as we now call it, the vitrifield wheel, was the one selected for experiment in the effort to keep pace with the progress of the machine. Notwithstanding its apparent disadvantages, however, the rubber-bond wheel has shown itself to be susceptible to development to a degree that is making it a formidable competitor of its more widely known and used counterpart, the vitrified wheel.

Since the days of its first appearance the rubber-bond wheel has been recognized as an exceptionally strong wheel, and, as it is to some degree elastic, it may be run at much higher speeds and subjected to more drastic treatment than wheels of clay bond. Wherever very thin wheels are desirable, as in necking, and cer-

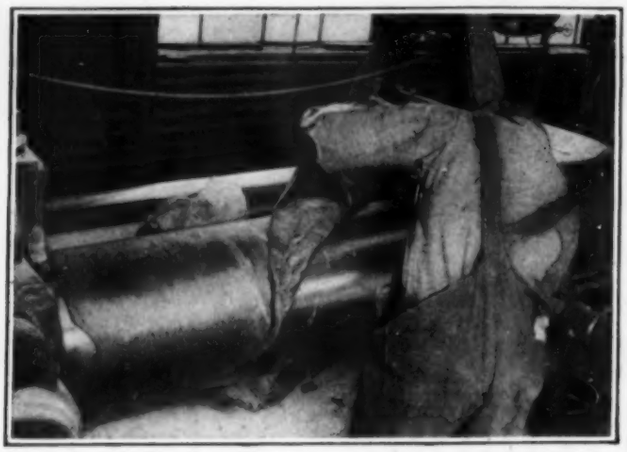


Fig. 2—Adding the vulcanizing ingredients

tain classes of cutting-off machines, it is generally preferred, as its strength and capability of high peripheral velocities render it very efficient for this purpose. Thin wheels of rubber bond are applied to the cutting of high-speed and alloy steels that would be difficult if not impossible to cut with a saw, and to cutting the sprues and risers from castings of nickel-steel, monel-metal, and other expensive materials where even the width of the kerf cannot be disregarded.

The early wheels usually contained more rubber than abrasive, and, as the latter was of inferior quality as compared with modern abrasives, the use of such wheels resolved itself into a process of burning away a great deal of rubber in order to do a comparatively small amount of grinding. A shop where rubber wheels were used to any extent was likely to proclaim its existence over a very wide radius indeed by the odor of burning rubber.

Constant study and experiment has enabled the producer of modern rubber-bond wheels to vary the nature of the bond to a considerable extent, and this variation taken in connection with the use of varying proportions of bond and abrasive gives the rubber-bond wheel almost as wide a range of characteristics as may be found in clay-bonded wheels. Though the term "hardness" is applied to both, the hardness of the rubber-bond wheel is due more to its degree of compactness and density than to its actual power of resistance to impact.

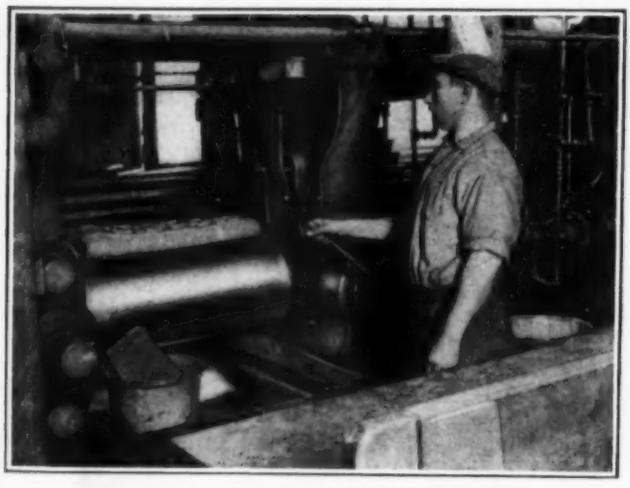


Fig. 3—Mixing the abrasive and rubber

One of the pioneers in the commercial production of rubber-bond wheels is the Manhattan Rubber Manufacturing Co. of Passaic, New Jersey, which concern has been making such wheels since 1896. To the manager of its wheel department, N. Clif Hilton, whose personal research work and experiments have done much to advance the art of making rubber-bond wheels and to widen the field of their application, we are indebted for the illustrations accompanying this article.

Rubber in its original form is, as most of our readers already know, the juice of certain trees and shrubs found in tropical climates, of which there are no less than twenty-five varieties that produce commercial rubber. As the juice exudes from a wound on the tree it has a milky appearance; hence its common designation of "latex." It is a sticky, viscous fluid that coagulates quickly upon exposure to air, and is collected by allowing it to dry in successive layers upon a wooden paddle or other convenient implement; thus building up a roughly pear-shaped ball. As each coating of the latex is applied, the ball is hung over an open fire to expedite the process of coagulation; the heat serving to arrest the natural transformation and "cure" the rubber while the smoke of the fire (which is incidental, and not a necessary part of the process) causes the whitish substance to turn a dark brown, or even black.

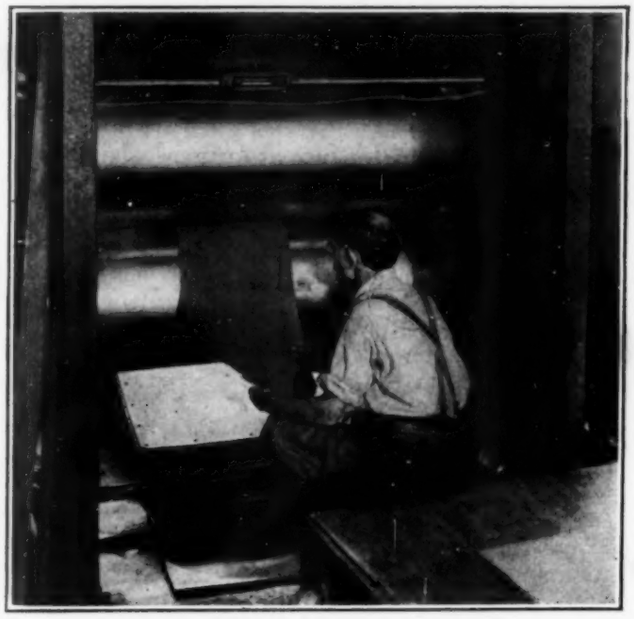


Fig. 4—Calendering the abrasive stock

These balls of crude rubber have been until recent years the form in which it was usually imported, but the steadily increasing demand for rubber has led to the establishment of mills at the source of supply, and these mills reduce the balls to sheets, removing some of the impurities that are bound to exist in the original collection and to put the rubber in shape for economic shipment.

The sheets as received at the factory are from $\frac{1}{16}$ to $\frac{1}{8}$ in. thick, of a rough, spongy appearance, reddish-brown in color and, though quite elastic, do not possess sufficient tenacity to prevent them from being torn apart with comparative ease. The first mechanical operation to be performed in the wheel factory is

variously known as "breaking-down," "milling," or "conditioning." Fig. 1 shows the means employed.

A pair of smooth-surfaced, cast-iron rolls about 18 in. in diameter are so geared together that the surface of one roll travels considerably faster than the other. Several sheets of the raw rubber, enough to fill the mill to capacity, are folded together and thrown between the rolls, by which the separate sheets are gradually squeezed and kneaded into a homogeneous mass. Instead of passing at once through the rolls the rubber adheres to and is wrapped around the slower moving roll until the latter is covered from end to end as with a blanket, the thickness of which is much greater than the space between the rolls.

At the beginning of the operation the excess rubber will pile up above the rolls to a considerable height, but as the kneading progresses this excess gradually disappears as the blanket builds up to a uniform thickness. A certain amount of heat is necessary to the operation, and this heat is supplied by the friction of the kneading

Fig. 5—Cutting out thin wheels

rubber. The rolls are hollow, and are piped through their journals for steam and cold water, the steam to heat them to the desired temperature at the beginning of the operation and the cold water to restrain the tendency of the rubber to get too hot.

The operation, though apparently simple, is one that calls for a considerable degree of skill, and a batch of rubber may be ruined by carelessly allowing the heat to run too high, or the operation unduly prolonged by keeping the rubber too cool. The amount of heat necessary varies somewhat with different batches of rubber and also at different stages of the operation, and is gaged solely by the operator according to the "feel" and appearance of the batch.

During the first part of the operation, which requires altogether a period of about thirty minutes, the noise from the rolls resembles a machine gun battery going into action, by reason of bursting bubbles of air trapped in the rubber and passing between the rolls.

In Fig. 1 the rolls are stopped and the operator is

Fig. 6—Cutting the thicker wheels

standing behind them. His usual position during the run is before the blanketed roll, and his duties consist mainly in watching and gaging the condition of the rubber and in keeping it from creeping over the flanges at the ends of the rolls. He is armed with a keen-bladed knife, and when the blanket of rubber threatens to creep beyond bounds he presses the point of the knife against the surface of the slowly revolving roll about an inch from one end, holds it stationary in that position while the roll makes one revolution, and peels off the narrow strip of rubber thus severed from the blanket. This strip he then doubles carelessly and throws back between the rolls midway of their length and repeats the operation at the opposite edge of the blanket.

Stripping the Rubber from the Roll

Occasionally he sweeps the point of the knife across the roll lengthwise, severing the blanket in a long diagonal cut. At the instant of starting the cut his disengaged hand seizes the advancing corner of the material and strips the whole mass from the roll as it unwinds from the underside of the roll following the diagonal cut. He then folds this blanket once or twice and casts it back into the rolls.

To anyone who has attempted to cut a sheet of rubber one-half an inch or more in thickness with even the sharpest of knives this job does not "listen" easy. It may *not* be easy—the writer has never tried it—but the hot rubber (too hot for the unaccustomed hand

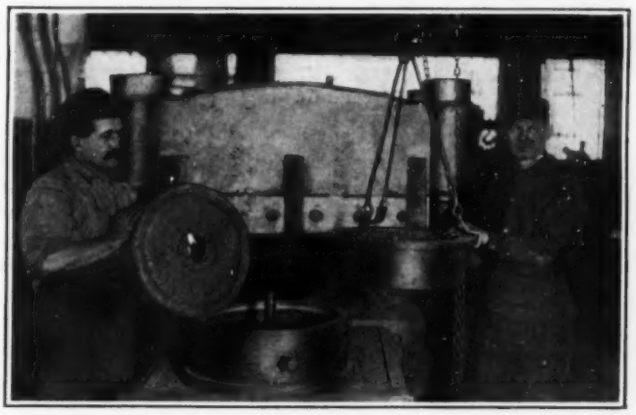


Fig. 7—Welding thin disks together to make thicker wheels

to hold with comfort) cuts very differently from cold rubber and the trained operator handles it as dexterously and nonchalantly as if it were but wet blotting paper. He appears to be ambidexterous, too; beginning the cut from either end of the roll at will and wielding the knife as handily with his left hand as he does with his right.

When the conditioning operation is completed, the rubber is taken off the roll in the same manner, coming off in the form of a trapezoidal-shaped blanket with parallel sides and with ends cut to an angle of forty degrees or less, according to the rate at which the knife was passed across the face of the moving roll.

In the second operation, known as "compounding," a batch of conditioned rubber is fed into the rolls and

Fig. 8—The wheel after being subjected to pressure

allowed to wrap itself around the slower moving roll as in Fig. 1, but before starting the operation the batch is carefully weighed and is trimmed, or scraps from another blanket added, until the desired weight is indicated by the scale. After the rubber is in the rolls a definite quantity of the vulcanizing ingredients (of which sulphur is the important element) is weighed out and dumped upon it, being quickly mixed with the rubber by the kneading action of the rolls.

Working the Abrasive Into the Rubber

The operation of compounding is not different, mechanically, from the preceding operation of conditioning; though more time is given to it, the material is not so hot, and the cutting and folding of the blanket is repeated even more frequently. When the ingredients have been worked thoroughly into the rubber the blanket has assumed a yellowish color and is now susceptible to heat. Fig. 2 shows the rolls stopped for photographing.

In Figs. 1 and 2 a light chain will be noticed, suspended with apparent carelessness between the housings of the rolls. This chain is a safety device that renders an apparently dangerous piece of mechanism innocuous. The weight of an operator's hand upon the chain, or any involuntary movement that disturbs its position, cuts off the driving motor and applies a powerful magnetic brake that will stop the rolls in less than one-seventh of a revolution.

In a following operation, shown in Fig. 3, the grains of abrasive are rolled into the rubber. As in the preceding operation the characteristic "hardness" of the finished wheels may be varied by the nature and proportion of the vulcanizing ingredients added to the rubber, so in this operation a further modification is effected by the proportions of rubber and abrasive. In this operation a sheet of the compounded rubber is laid in the pan beneath the rolls and a quantity of the abrasive spread upon it. It is then folded over upon itself, more abrasive added, and the blanket again folded and passed into the rolls.

The operation of compounding has eliminated much of the tendency of the rubber to stick to the rolls and this tendency is further reduced by the addition of the abrasive, so that when the folded blanket is placed between the rolls it immediately passes through them to the pan below and in its passage is restored very nearly to its original size and thickness. The remainder of the operation is merely a repetition of the folding and rolling until all of the weighed batch of abrasive has been incorporated into the rubber.

Calendering the Sheets

The fourth set of rolls, shown in Fig. 4, is used to calender the sheets. The mill here illustrated happens to be a three-high train but the upper roll is not used, as it has been found that one operator can handle the work to better advantage. The object of the operation is to reduce the sheet of abrasive material to a uniform and definitely measured thickness from which the wheels are to be cut.

Thin wheels are cut from the sheets of abrasive material by means of the pneumatically operated press shown in Fig. 5. The cut-out centers are available for wheels of smaller diameter, or, if too small for that purpose, go back to the rolls to be made into sheets again, so that there is practically no waste material. Thicker wheels are cut out on the machine shown in Fig. 6, the knives of which may be adjusted along the revolving bar to cut any diameter of wheel or size of hole within the range of the machine.

The thickness of a wheel that may be cut from a single sheet is limited to the thickness that can be handled by this machine, but because of the facility with which the material welds together under the influence of pressure and moderate heat it is possible to make wheels of any desired thickness and perfect homogeneity by superimposing any number of disks in suitable dies and squeezing them together. In Fig. 7 the reader will observe how the wheels are bound together, ready to be placed in the die or mold; and in Fig. 8 may be seen such a wheel after the pressure has been applied by the hydraulic press. Moderate heat (below the vulcanizing temperature) is applied during this process by means of steam heated platens above and below the molds.

Besides the methods of controlling the "grade" of a rubber-bond wheel involved in the compounding and mixing operations above described, a further modification is effected in the vulcanizing process. This process and the later operations that go toward the making of the finished product will be discussed in another article to be published soon.

Cutter Shapes for Milled and Ground Threads

By Ernest Wildhaber

Involute helicoidal and common screw threads—Determination of cutter profiles for various threads—Curvature radii of normal sections and outlines of threads—Worm threads

WHEN screw threads are to be milled or ground by means of cutters or wheels with straight, convex, or concave profiles, there are two aspects of the problem to be considered. First, the shape of a thread produced by a given cutter and, second, the determination of the shape of cutter required to produce a given thread. The following analysis of this problem is thought to be novel and the relations between the cutter and the thread will be found to be unexpectedly simple. The analysis is particularly important for worm threads and comparatively steep screw threads.

Two shapes of thread are worthy of especial consideration, and one of them is the thread that has a straight profile in a section through the axis of the thread. This is the common screw thread. The contour of this thread is, however, somewhat concave, that is, the common screw thread has a concave outline when observed in the direction of the thread. The other important thread has a straight contour or outline when viewed in the direction of the thread, or in any other direction, for that matter. This thread will be called involute helicoidal thread, because it has an involute profile when intersected by a plane at right angles to its axis. However, neither the normal nor the axial section profiles are involutes.

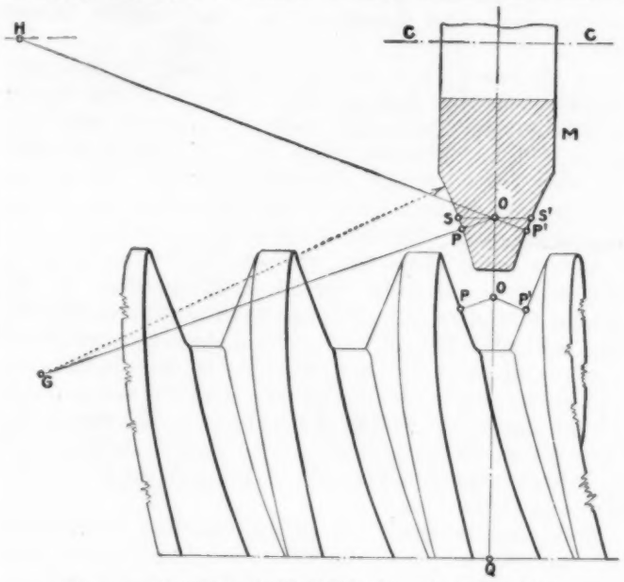


Fig. 1—Involute helicoidal thread and cutter

When used on worms the common screw thread has sometimes been called involute thread but the term is a misnomer. Such thread neither contains involutes, nor does it fit the involute system of gears. The worm thread that does properly mesh with a helical involute gear is an involute helicoidal thread. In other words, the thread that fits the involute system of gears is the thread with the straight outline in the view along the thread, and not the thread with the straight profile in the axial section.

Characteristics of Common Screw Thread

The common screw thread is the older and can be most easily cut by the older thread-cutting tools. When a thread is cut on the lathe, the common screw thread is the result. In milling, however, the common screw thread requires a slightly convex cutter, while a slightly concave cutter is required to mill the involute helicoidal thread. The production of both threads by milling is about equally complicated. The usual thread milling cutter has a straight cutting profile and, when set at the lead angle, it produces neither the common screw thread nor the involute helicoidal thread, but a thread that lies somewhere between the two and whose characteristics are quite different.

Although neither of these threads has an advantage over the other for milling, the involute helicoidal thread has an advantage when coarse threads are to be ground, and the wheel is to cut on only one side of the thread at a time. This advantage lies in the use of a flat-sided wheel, the size of which does not affect the shape of the thread and whose plane surface can be easily and accurately dressed. Every helicoidal thread produced with a flat wheel is of the involute helicoidal shape. In all other cases, however, the shape of the thread depends not only on the profile of the grinding wheel, but also to some extent on its diameter.

Let us first consider the milling of involute helicoidal thread, the character of which is identical with helical involute teeth. The thread is merely inclined at a greater angle with respect to its axis than are the teeth and, therefore, the results of the analysis on the milling of helical involute teeth can be directly applied to this problem. This analysis was published on page 909, Vol. 59, of the *American Machinist*.

The formula derived in the above-mentioned analysis was as follows:

$$R' = \frac{R \sin \alpha}{\cos^2 h} + R_c \sin \alpha \tan^2 h$$

in which,

R' = Radius GO of cutter, Fig. 1, and equal to the curvature radius GP plus OP

R = Mean or pitch radius of thread, OQ, Fig. 1

α = Thread profile angle in a normal section measured from the radius, and also the inclination of the cutter profile

h = Helix angle at radius R, or the angle of inclination of the thread with a line parallel to the axis of the screw

R_c = Mean or pitch radius of the cutter. In Fig. 1, $(R_c + R)$ = center distance, CQ

This formula can also be written in terms of the lead angle h', which is equal to 90 deg. minus h, and is the angle of inclination of the thread at radius R with concentric circles drawn in a plane perpendicular to the axis of the screw.

$$R' = \frac{R \sin \alpha}{\sin^2 h'} + R_c \frac{\sin \alpha}{\tan^2 h'} = \frac{\sin \alpha}{\tan^2 h'} \left(\frac{R}{\cos^2 h'} + R_c \right)$$

$$= \frac{\sin \alpha}{\tan^2 h'} \left[R(1 + \tan^2 h') + R_c \right] \qquad (1)$$

This formula can be used to determine the curvature of the cutter profile to be used in cutting an involute

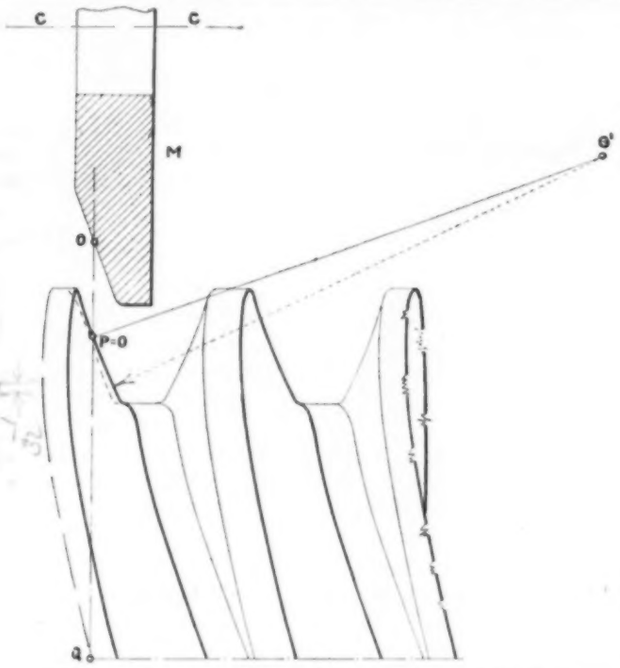


Fig. 2—Cutter with straight profile and thread

helicoidal thread, with a profile angle α in the normal section, and a lead angle h' at the pitch radius R. A concave cutter profile is required, as illustrated in Fig. 1, and can be very closely approximated by an arc drawn from the center G, with the radius GP, which equals $(R' - OP)$. Fig. 1 also shows the kind of thread produced, the view being taken in the direction of the thread. As has been previously pointed out, the outline of the involute helicoidal thread is straight. During the cutting operation the pitch point O of the thread coincides with pitch point O of the cutter; the normal distances OP are the same on the thread and on the cutter; and the profile inclinations at P are identical for both cutter and thread.

The application of the formula will be better understood by its use in a simple example and the following additional symbols will be used:

L = Lead of thread in inches

N = Number of threads (for quadruple thread, $N = 4$)

Let us determine the radius of curvature of the cutter profile to produce a thread with the following proportions:

$\alpha = 14\frac{1}{2}$ deg., $L = 4$ in., $R = 2$ in., $R_c = 1\frac{1}{2}$ in., $N = 4$. The thickness of the thread at the pitch circle is usually one-half the pitch, and will be so taken here.

$$\text{Pitch along the normal helix} = \frac{L \cos h'}{N}$$

$$\text{Thread thickness along normal helix} = \frac{L \cos h'}{2N}$$

$$\text{Distance } OP = \frac{L \cos h'}{4N} \cos \alpha = 0.230 \text{ in.}$$

Using formula (1) for the determination of R', we will then be able to subtract the value of OP which we have just found and obtain the value of GP, the radius of curvature of the cutter.

$$\sin \alpha = \sin 14\tfrac{1}{2} \text{ deg.} = \tfrac{1}{4}; \quad \frac{\sin \alpha}{\tan^2 h'} = 2.47$$

$$R(1 + \tan^2 h') + R_c = 1.1013R + R_c$$

$$= 2.2026 + 1.5 = 3.703$$

$$R' = 2.47 \times 3.703 = 9.15 \text{ in.}$$

Radius of curvature,

$$GP = R' - OP = 9.15 - 0.23 = 8.92 \text{ in.}$$

It will be noted that the location of the curvature center G is independent of the cutter thickness for involute helicoidal thread and that the distance from G to O is the same for any distance OP, provided that h' and α are the same. This feature is characteristic of involute helicoidal thread and no other form of thread has it.

In all cases when the milling cutter has the particular concavity figured above, the produced thread will be involute helicoidal, but as a rule the cutter on hand will be different, since it may have a straight or other curved profile. Such a cutter will, of course, produce something other than involute helicoidal thread, and these other threads will now be considered.

It was noted above that the position of the center G for involute helicoidal thread is independent of the thread thickness and, although this is not strictly true for any other thread, its position does not depend to any extent on the thread thickness or the thickness of the cutter. We can, therefore, simplify the problem by calculating the radius of the cutter profile merely for the case which works out in the simplest manner, that is, where point P is located on the pitch circle and the distance OP is zero.

This case is sometimes exactly realized in grinding threads with one side of the wheel, but rarely when milling threads, since it presupposes cutting on only one side at a time. Such a supposition produces very simple results, however, which can be applied approximately to all other cases.

The modified problem is illustrated in Figs. 2 and 3. In Fig. 2 a grinding wheel M with a straight profile is shown in an axial section and the thread which it produces is shown in its corresponding position, that is, in a view taken in the direction of the thread. The view is taken at the angle h' and the axis of the thread, therefore, intersects the plane of the drawing at the point Q, while the axis of the cutting wheel M lies in the drawing plane. During the cut, point O of the cutting wheel coincides with point O of the thread.

A straight-sided cutter will produce a thread with a

concave outline, in a view taken in the direction of the thread, but with a convex profile in its axial section. The outlines are shown by the full lines in Fig. 2, the sectional profile being indicated by the dotted line. A circular arc drawn from the center G' will closely approximate the outline of the thread. The point G' is located, on the perpendicular through O, and it is now necessary to determine the distance $G'O$, together with the curvature of the thread profile in a normal section in order to ascertain the characteristics of the thread.

A common screw thread, together with its cutter, is illustrated in Fig. 3 and it will be noted that its outline, in a view along the thread, is generally more concave than the thread illustrated in Fig. 2. The profile of the cutter required to produce this thread is slightly convex, as shown.

A reproduction of Fig. 5 from the article on the milling of helical involute teeth, previously referred to, is shown in Fig. 4. This is a topographical map of a cutter body in cutting contact with an involute helicoidal

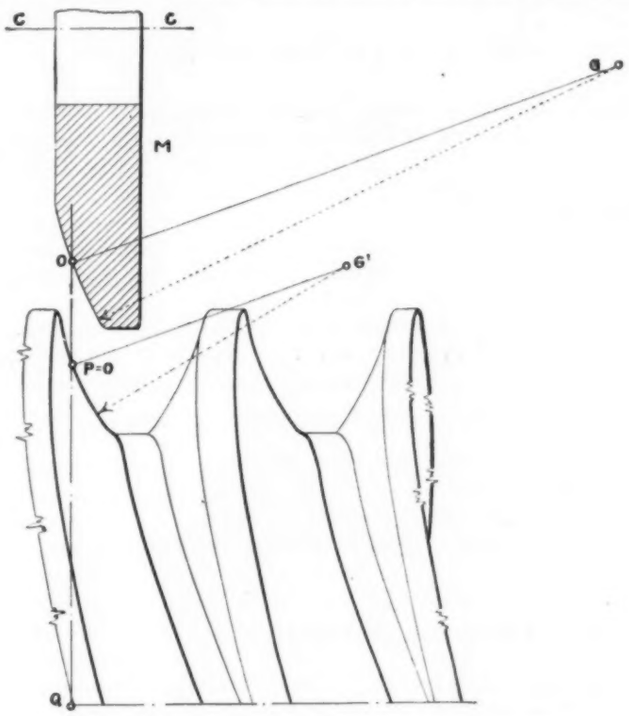


Fig. 3—Common screw thread and cutter

surface. The lines 1, 2, 3, 1′, 2′ and 3′ are lines on the cutter body, drawn through points of equal elevation from the common tangential plane through P. In like manner the lines I, II, III, I′, II′ and III′ indicate equal elevations on the involute helicoidal surface. It is apparent that the two surfaces contact along the line F-F, drawn through the intersections of the contour lines of the cutter body with those of the involute helicoidal surface.

For the present problem where points P and O coincide, the line P-X will be the tangent to the helix through P and line P-Y will remain the direction of the meridian profile of the cutter. Let us now endeavor to transform the involute helicoidal thread surface and its cutter surface, in order to determine the relation of any other thread surface to its corresponding cutter surface.

This is done by subtracting from the elevations or ordinates of the cutter surface, illustrated in Fig. 4, the ordinates of a cylindrical surface which will make contact with the common tangential plane through P along the line P-X. We can also add the ordinates of the cylindrical surface to the ordinates of the involute helicoidal surface, and by this series of operations a new cutter surface and a new thread surface will be derived. These new surfaces will still contact along the line F-F, since the ordinates of the cutter and thread surfaces will still be equal along this line. It has also been found that this new thread surface is still a part of a helicoidal surface, and it, therefore, fulfills the requirements. It should be kept in mind that this new thread surface represents any thread other than the involute helicoidal.

By means of the foregoing transformation the cutter will assume a new profile and the outline and sectional profile of the thread surface will also be changed. The outline of the involute helicoidal thread, as indicated by Figs. 1 and 4, is straight, but the outline of the new thread will be concave. Its curvature radius equals the curvature radius of the added cylindrical surface and will be called R'' in the following analysis. As usual, R'' will be introduced as a negative amount when it denotes a concave thread outline.

The curvature radius of the profile of the cutter for involute helicoidal thread is $-R'$, and the reciprocal of the curvature radius of the new cutter profile can be written as

$$-\left(\frac{1}{R'}+\frac{1}{R''}\right)$$

The curvature radius itself is

$$\frac{R' \times R''}{R' + R''} \qquad (2)$$

In a normal section the curvature radius of an involute helicoidal thread equals $+\frac{R \sin \alpha}{\sin^2 h'}$, the positive sign denoting a convex curvature. From this the reciprocal of the curvature radius of the profile of the new thread in the normal section is found to be

$$+\frac{\sin^2 h'}{R \sin \alpha}+\frac{1}{R''} \qquad (3)$$

If it is desired to find the relation between a straight-sided cutter and its thread, Fig. 3, the radius R'' of the cylindrical surface to be subtracted, must be equal to the radius R' of the profile of the cutter for involute helicoidal thread. The curvature radius PG' of the produced thread outline is then $-R'$, and its amount is given by formula (1). This gives R' a double significance, for it is the curvature radius of the thread outline produced by a straight-sided cutter, and it is also the curvature radius of the cutter profile for producing involute helicoidal thread. The curvature radius of the normal section profile of the thread produced by a straight-sided cutter will be $+\frac{R' \times R}{R_c \cos^2 h'}$ This is found by substituting $-R' = -\frac{\sin \alpha}{\tan^2 h'}$ $[R(1 + \tan^2 h') + R_c]$, in the general formula (3) for the reciprocal of the curvature radius of the normal profile.

Another thread that is of some importance is the thread which has a straight profile in a normal section, since it can be conveniently cut on the lathe. The curvature of the straight normal profile will, of course,

equal infinity, and the expression for the reciprocal of the normal profile curvature radius, formula (3), will equal zero. Therefore

$$\frac{\sin^2 h'}{R \sin \alpha} + \frac{1}{R''} = 0$$

$$R'' = -\frac{R \sin \alpha}{\sin^2 h'}$$

This expression for R'' represents the curvature radius of the thread outline, as well as the radius of the auxiliary cylindrical surface that is subtracted from the surface of a cutter for involute helicoidal thread. By introducing this value for R'', together with the expression for R' from formula (1), in the general formula (2), the curvature radius of the milling cutter for this thread can be expressed as $+R' \frac{R}{R_c \cos^2 h'}$, in which the positive sign indicates a milling cutter with a convex profile.

Another important screw thread is the common screw thread with a straight profile in the axial section, and it has been found that it also has a concave thread outline. The value of the curvature radius for the thread outline is

$$R'' = -\frac{R \sin \alpha}{\sin^2 h' \cos^4 \alpha}$$

from which the radii of the cutter and normal thread profiles may be determined by introducing this amount into the general formulas (2) and (3).

All of the foregoing values for the various curvature radii are collected in the accompanying table. It will be noted that the common screw thread, which has a straight axial section, is not identical with the thread that has a straight normal section, since the profile of the common screw thread in a normal section is slightly concave. Moreover, it is evident that a rotary cutter with a straight profile will not produce a thread with a straight normal section, nor will it, as a rule, produce common screw thread. The normal section of the thread produced by such a cutter is somewhat convex and the degree of curvature changes with the diameter of the milling cutter or grinding wheel.

The thread actually produced by a given cutter can be readily determined by means of the formulas given, and also the manner in which it differs from the thread desired. The necessary convexity or cancavity of a cutter to produce a given thread can also be accurately

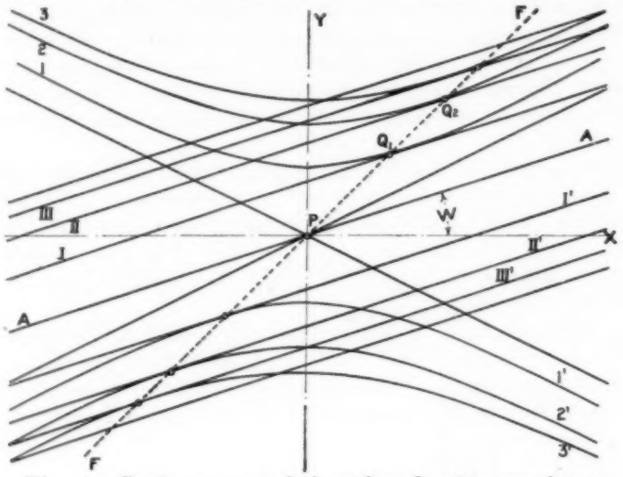


Fig. 4—Contour map of thread and cutter surfaces

found, so that a thread may be produced by milling or grinding which will be interchangeable with a thread cut on a lathe. The use of the formula will be illustrated by the following examples, in which the former symbols are used.

Example I—The shape of the normal profile of the thread, used in the calculation of the cutter radius curvature above, is to be determined.

$L = 4$ in.; $R = 2$ in.; $N = 4$; $R_c = 1.5$ in.; $\alpha = 14\frac{1}{2}$ deg.

This thread is to be cut with a milling cutter of straight profile. From the table we find that the curvature radius for the normal section is $+R' \frac{R}{R_c \cos^2 h'}$. In the former calculation we determined that the value of R' for this thread is 9.15 in., and the substitution of this and the other numerical values in the above expression gives +13.44 in. for the curvature radius of

Table of Curvature Radii for Various Threads and Cutters

$$R' = \frac{\sin \alpha}{\tan^2 h'} \left[R(1 + \tan^2 h') + R_c \right]$$

Kind of thread	Curvature Radii of: Cutter Profile	Thread Outline	Normal Section	Axial Section
Involute helicoidal thread	$-R'$	∞	$+\frac{R \sin \alpha}{\sin^2 h'}$	
Common screw thread	$+R' \frac{R}{(R + R_c \cos^2 h') \cos^4 \alpha - R}$	$-\frac{R \sin \alpha}{\sin^2 h' \cos^4 \alpha}$	$+\frac{R \sin \alpha}{\sin^2 h' (1 - \cos^4 \alpha)}$	∞
Thread produced by rotary cutter with straight profile	∞	$-R'$	$+R' \frac{R}{R_c \cos^2 h'}$	
Thread with straight profile in normal section	$+R' \frac{R}{R_c \cos^2 h'}$	$-\frac{R \sin \alpha}{\sin^2 h'}$	∞	
Any thread (general formulas)	$-\frac{R'R''}{R' + R''}$	R''	$\frac{RR'' \sin \alpha}{R'' \sin^2 h' + R \sin \alpha}$	

the normal profile. The positive sign indicates a convex profile.

Example II—In the operation of grinding worm thread with a straight-profile grinding wheel, the pitch diameter of the wheel shrinks during its life. The shape of the thread produced by a new wheel will be somewhat different from the thread ground by the used wheel. Assuming that the pitch radius R_c of the new wheel is 5 in., and that this dimension is allowed to shrink to 3 in. before the wheel is discarded, let us determine the curvature radii of the thread outlines and the normal profiles corresponding to the limiting pitch radii of the wheel. The thread has the following proportions:

$$a = 20 \text{ deg.}; \; L = 4 \text{ in.}; \; R = 2 \text{ in.}$$

From the table we find that R'', the curvature radius of the thread outline, equals

$$-R' = -\frac{\sin a}{\tan^2 h'} [R(1 + \tan^2 h') + R_c)$$

Substituting the numerical values, R'' is found to be —24.32 in. for a wheel radius of 5 in., and —17.37 in. for the 3-in. radius.

The expression for the radius of curvature of the normal section is found from the table to be

$$+R' \frac{R}{R_c \cos^2 h'}$$

and the numerical values for this expression are 10.71 and 12.90 in., respectively, for the given wheel radii. These values indicate the variations in the thread caused by the shrinkage in the wheel diameter.

The above thread may be considered as a ground worm thread, and the hob for machining the mating wormwheel is supposed to correspond accurately to the worm. Frequently, however, hobs are relieved on the lathe with a straight-sided tool, so that the hob thread actually has a straight profile in a normal section. If such a hob were used to cut a wormwheel to mesh with the ground thread above, which is convex in the normal section and has an average curvature radius of 12 in., it is apparent that the worm and wormwheel would not mesh properly.

Example III—A common screw thread is to be accurately produced with a milling cutter, and it is necessary to find the required curvature radius for the cutter profile.

$$a = 20 \text{ deg.}; \; L = 4 \text{ in.}; \; R = 2 \text{ in.}; \; R_c = 1.5 \text{ in.}$$

The expression for the desired radius is found to be

$$+R' \frac{R}{(R + R_c \cos^2 h') \cos^4 a - R}$$

The substitution of the numerical values in the formula for R' at the head of the table gives $R' = 12.50$ in. and the value of the cutter profile radius is found to be 40.29 in. Since this radius is so great, it is evident that in this case a cutter with a straight profile would produce a common screw thread that would be very nearly accurate.

The Genesis of a Dual Personality

A Sequel to "Come-iners" and "Come-outers"

By D. Wright

On page 458 of the *American Machinist* Harry Senior undertakes to sub-divide the executives of the industrial world into two classes, termed by him "come-iners" and "come-outers." Not to beat about the bush at all, we know just what he means, having belonged to both of these species ourself at one time or another.

Remembering the old saw: "It makes a lot of difference whose ox is gored" (or words to that effect), it is safe to assume that our friend is of the great throng who have a cause to advance, and has cooled his heels in an inhospitable office lobby while awaiting the forthcoming of a busy executive who would then accord him a brief interview, or has been invited to enter the inner sanctum and there "show his stuff."

While thoroughly appreciating Mr. Senior's point of view and taking him frankly at his own valuation when he says that he has "always endeavored to leave more of value than he took away," the reasons for the oft-repeated transition of any given executive from the "come-iner" to the "come-outer" class, and vice-versa, are so outstandingly apparent to one who has frequently made the shift that I feel a statement with regard to the other side of the question is but fair. At the same time, in cases where the caller's purpose is sincerely honest, such an exposition of the "other fellow's" side may assist him in adjusting himself to fit.

Now, right of the bat, let's kill off any notion existing in a disgruntled caller's mind as to the hide-bound unprogressiveness of the executive upon whom he has called that is based entirely upon the particular kind of reception he has been accorded. To-be-sure, there are still in the managerial game, as in other lines of activity, those chronic crabs who, because of short-sighted egotism or other conceit, believe in "running their business without outside help"; but as a general rule this class is dying out, and, where still alive, is due for an early extinction. In these days of constant progress and development it is the worst of bad business for any manager complacently to shut out all constructive visitation on the theory that he has reached the absolute limit of achievement.

No! the executive, if he be worthy of the name, is constantly alert to pick up from any source whatsoever any points that will enable him to strengthen and improve his organization, methods or product. Were it not so, such an up-to-the-minute review of current industrial development as the *American Machinist* would not number such executives among its personal subscribers.

Executive Must Use His Discretion

But in dealing with a caller, unlike the technical publication that may be laid aside to await opportune moments, it is necessary either to take the time to see him immediately upon presentation of his card or to set an arbitrary time for a later interview. Now the average executive, subject as he is to plant activities, endeavors to be definite and punctual, but he well knows that though at 10 a.m. it may seem perfectly feasible to make an appointment with a caller for 2:30 p.m., there are a lot of things that can develop in the intervening four-and-a-half hours to make it inconvenient if not impossible to grant the promised interview.

If he is at all conscientious, and, all evidence from

the caller's point of view to the contrary notwithstanding, most executives *are* conscientious, he hesitates to suggest that the caller take the time and trouble, and incur the expense, of a return visit when there is a better way out of the situation. So, temporarily ditching, as he may be able, whatever may be occupying his thoughts and—usually—his desk, he steps forth to see the visitor in the lobby or public reception room, instead of postponing the interview.

"But," argues our salesman friend, "if he can give the time, why cannot I be accorded the courtesy of this man's private office?"

Persistence of Some Salesmen

There may be, and probably is, in the back of the executive's mind a vivid recollection of similar callers to whom he has extended the courtesy of a private audience in his office, who, though he has given them to understand that he is not immediately interested in their proposition, have abused his courtesy by ignoring the probability of their host's preoccupation, taking off their wraps, opening out displays and consuming seemingly endless time in routine, aggressive, argumentative "sales talk." One or two such experiences effectively stamp upon the mind of the executive the inadvisability of permitting a caller to get too firmly entrenched unless his project is something of actual immediate worth and interest or the man is personally known for a tactful visitor.

To illustrate—since our friend Mr. Senior is admittedly in the machine tool trade—let me sketch an instance in his "home field" to show what I mean. Not long ago in the course of a busy morning there was brought to me the card of a representative of a well-known jobbing house with which, because of its ready accessibility and convenience, it has been my custom to place a large percentage of our very occasional machine tool orders.

By way of parenthesis I will say at this point that our product is such as to require only small, light and high-speed tools; our only heavy equipment consists of a few planers, boring mills, etc., that are used only upon a semi-occasional jobbing basis; that we were not expanding; that our equipment is reasonably modern; and that our policy of replacement is such that we were not at that time interested in machine tools of any kind.

Abuse of Privilege

However, as my relations with the house had always been very satisfactory, and wishing to make the caller feel that his efforts to serve our interests were appreciated, I had him escorted in. Whether or not I greeted him in just the manner that my contemporary sets up as a model I do not know, but I think I was reasonably cordial. At the same time I endeavored to make it clear to him that I was in the midst of a particularly engrossing problem along other lines, was not in any way interested in machine tools at the time, and had merely wanted to say "Howdy" to let him know we were glad to see him.

To shorten the story and make it as painless as possible, the upshot of the matter was that, since we were *not* buying any tools that morning, we were given the whole line of selling talk, with marginal references and footnotes, upon a new design of heavy-duty planer that the house had recently added to its line and which by no stretch of the imagination could ever be utilized in our plant.

This is not just an isolated case. Experiences of my own and observation of the experiences of others have convinced me that the ordinary run of people who call upon business establishments have a lot to learn about the psychology of suiting their approach to the conditions then existent in the programs of their subjects. Pleasant as it would be for all concerned if every visitor could be received in private audience, let those visitors themselves who are inclined to criticize the Dr. Jekyll and Mr. Hyde element in the make-up of the average executive as evidenced in the reception of callers, ask themselves how many times they have seen time wasted and patience tried by wordy and inconsiderate salesmen who in their enthusiastic ignorance have set the exposition of their own proposition above the immediate interests of the prospect.

No! I am *not* against the present method of sales presentation. In fact I know quite a number of bully, fine, practical sales representatives to whom the door of my office is open at any time. They are direct, intelligent and considerate; and are willing to concede that I may possibly know something about my personal requirements though reciprocating their regard by a firm belief in the honesty of their purpose whenever I really need their help.

Men Who Are Always Welcome

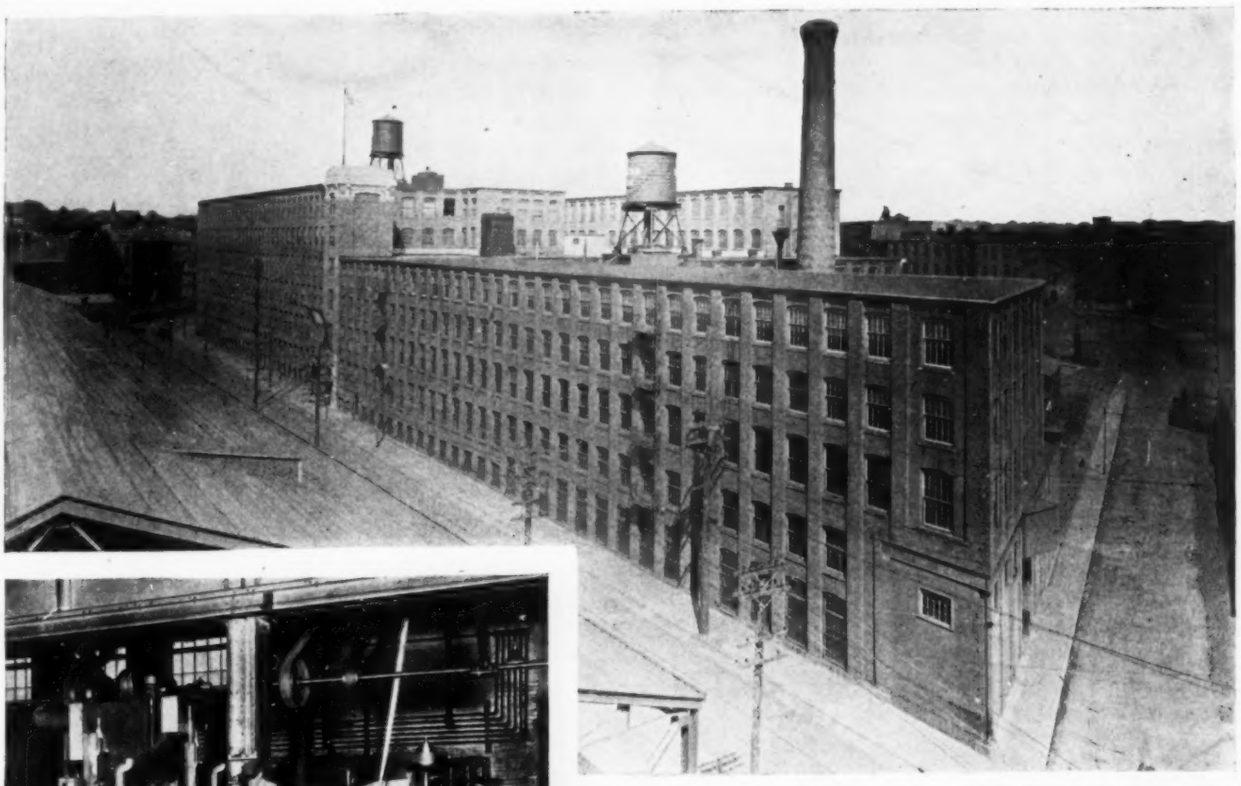
Such men have never squandered a nickel's worth of my time or theirs on propositions not pertinent to the particular occasion, and I do not believe they have felt aggrieved when the exigencies of the case have made it expedient to exchange our words of cheerful greeting in the lobby of the office or even on the front walk.

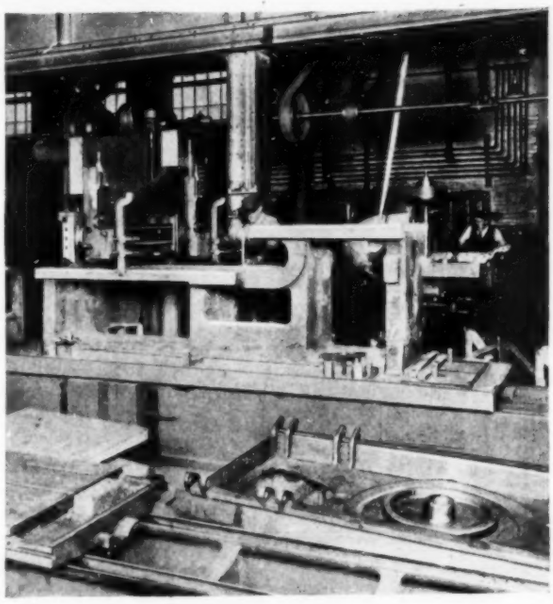
The list to whom I would be classed as a "come-iner" is constantly growing, but, having had distinctly unpleasant experiences with another class, composed, perhaps, of men who may be just as earnest representatives of just as high-grade product as the others, I take pretty good care to analyze a visitor's card as to probable interest in his proposition or possible past experience with him personally. To many of the latter class I am very likely to become for the time being a "come-outer."

I do not believe that my attitude in this respect differs from that of the great majority of executives whose duties make it necessary to establish contact with representatives of outside concerns. The average man wants to be courteous and agreeable, but, subject as he is to interferences from within his own plant, he must often make his outside contacts a matter of opportunity; and the sooner the representatives of the outside concerns sense this condition and adjust their methods to meet it the sooner will all business interviews be made more agreeable, helpful and generally satisfactory.

A Correction

In the article "Slip, Friction and Stretch Tests for Leather Belting," published on page 469, the formula for calculating friction was given as $\frac{T_1}{T_2} T_1 = e^{fa}$. It should have been $\frac{T_1}{T_2} = e^{fa}$.

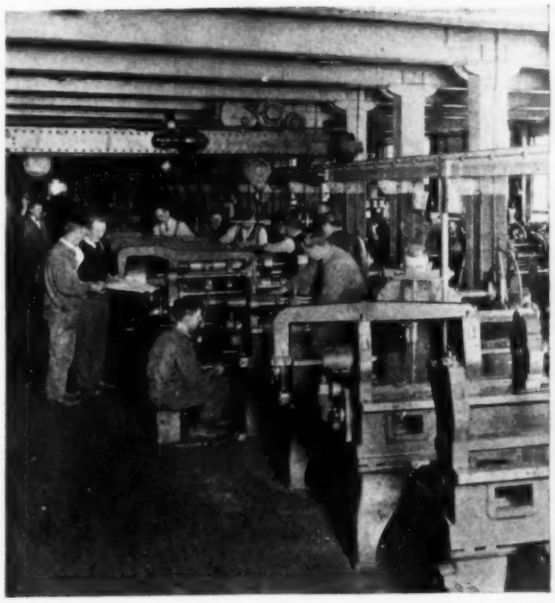


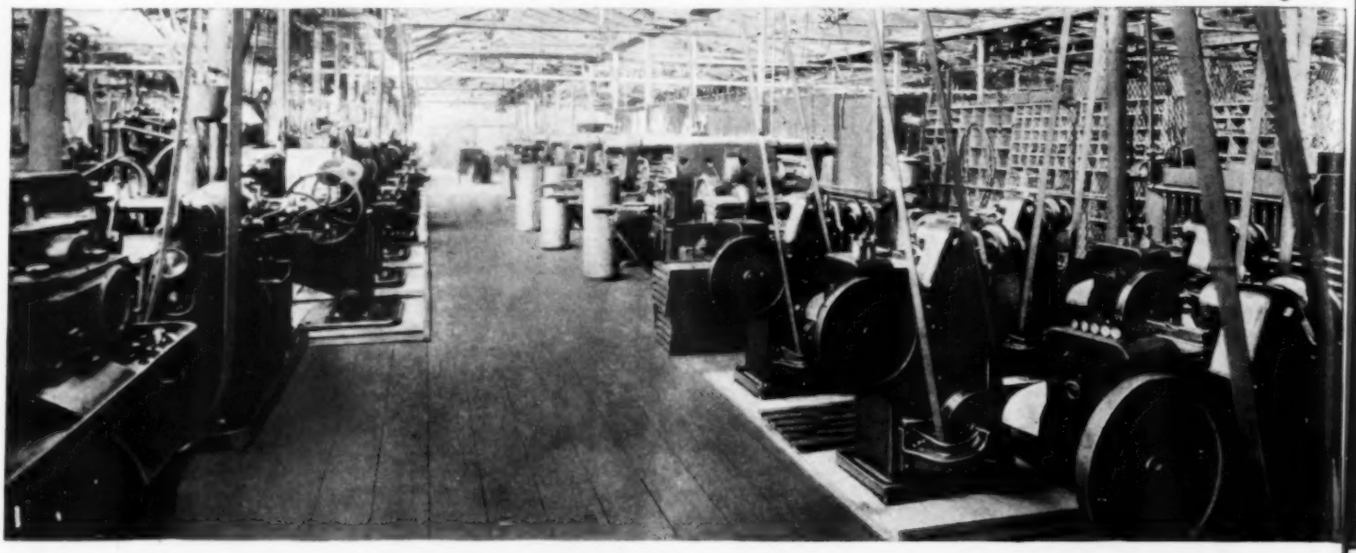


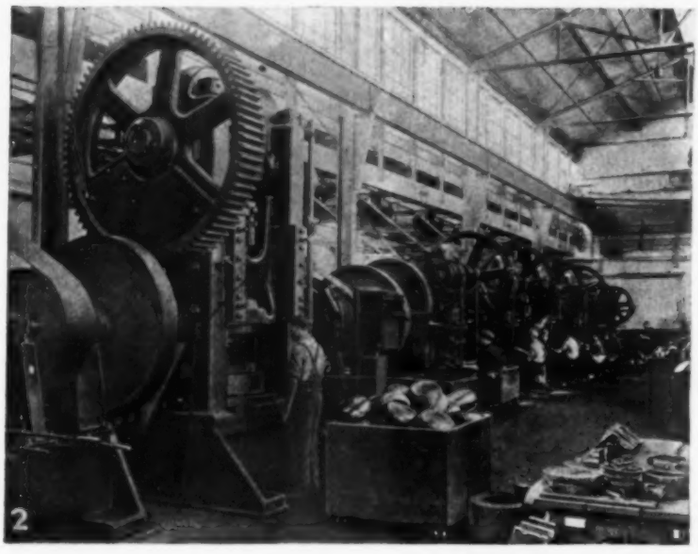
Where Machine Tools Are Made

The New Britain Machine Co.

Founded 1895





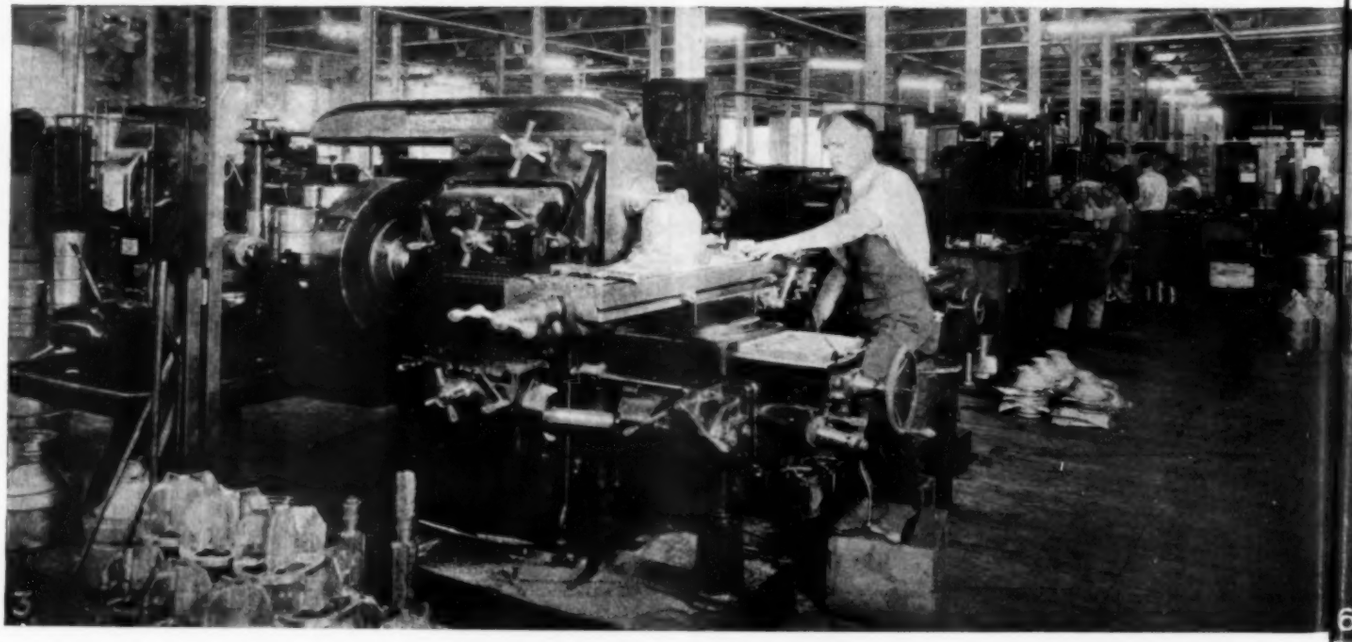


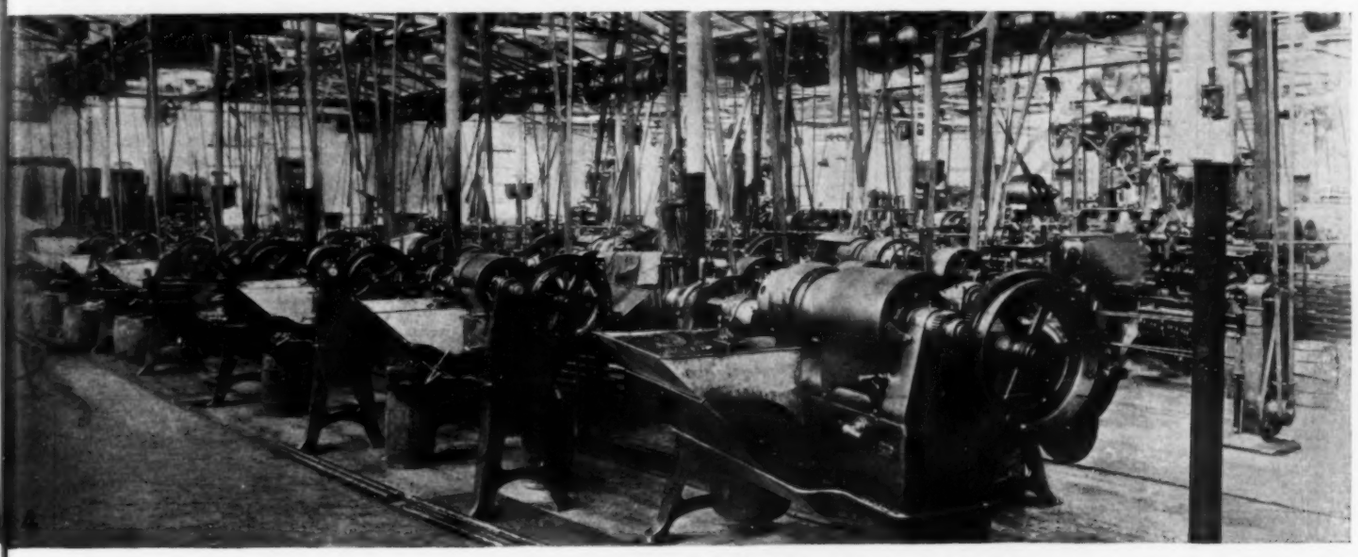
Supplementing the C

Fig. 1—Gear-cutting machines built and used in De Laval plant

Fig. 2—A row of presses making sheet-metal parts

Fig. 3—Milling inner bowls for oil clarifiers





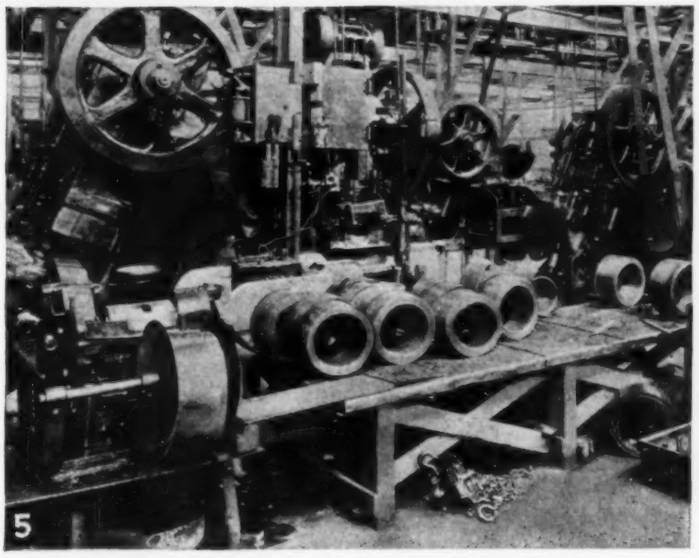
Cow's Mechanism

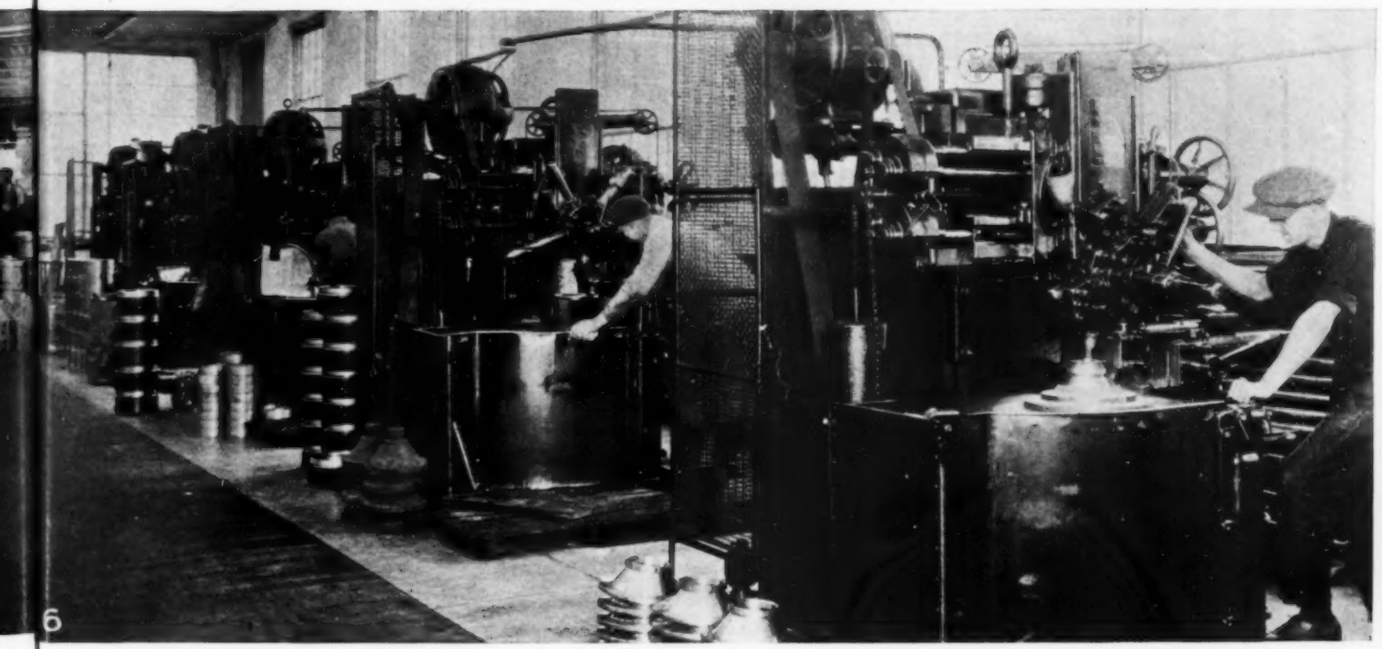
Fig. 4—Automatic screw machines making small parts

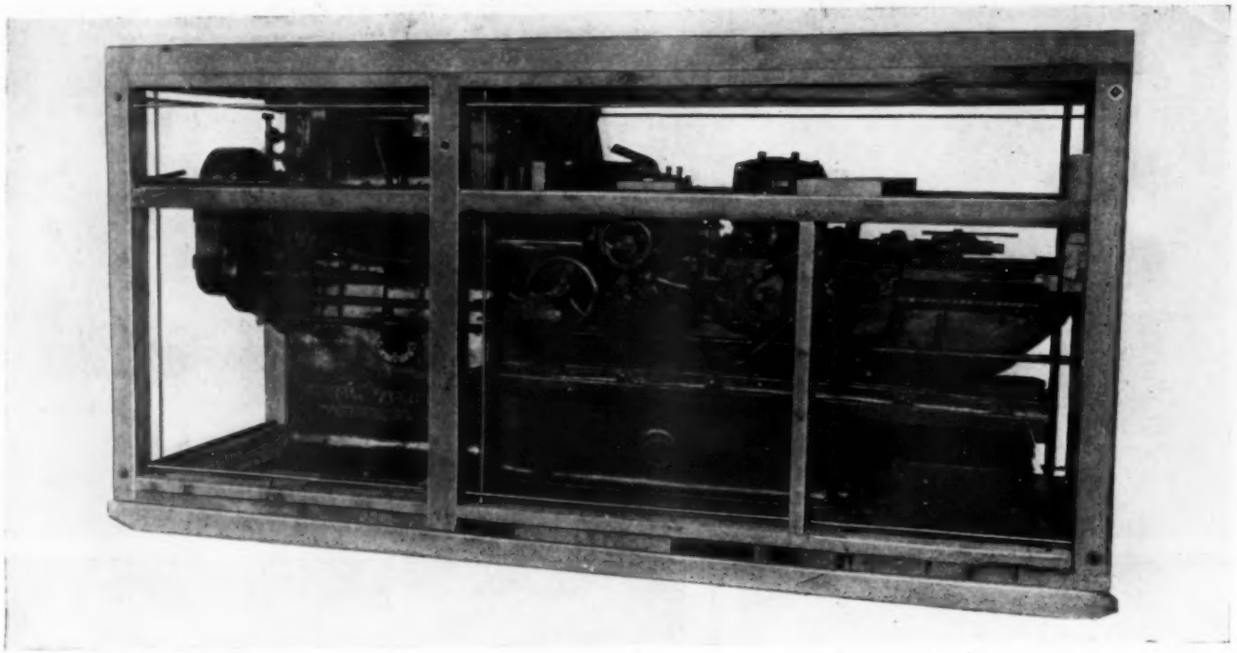
Fig. 5—Part of a battery of 18 presses making bowl disks

Fig. 6—Vertical turret lathes used in making bowl tops and shells

Photographs by courtesy of the DeLaval Separator Co.





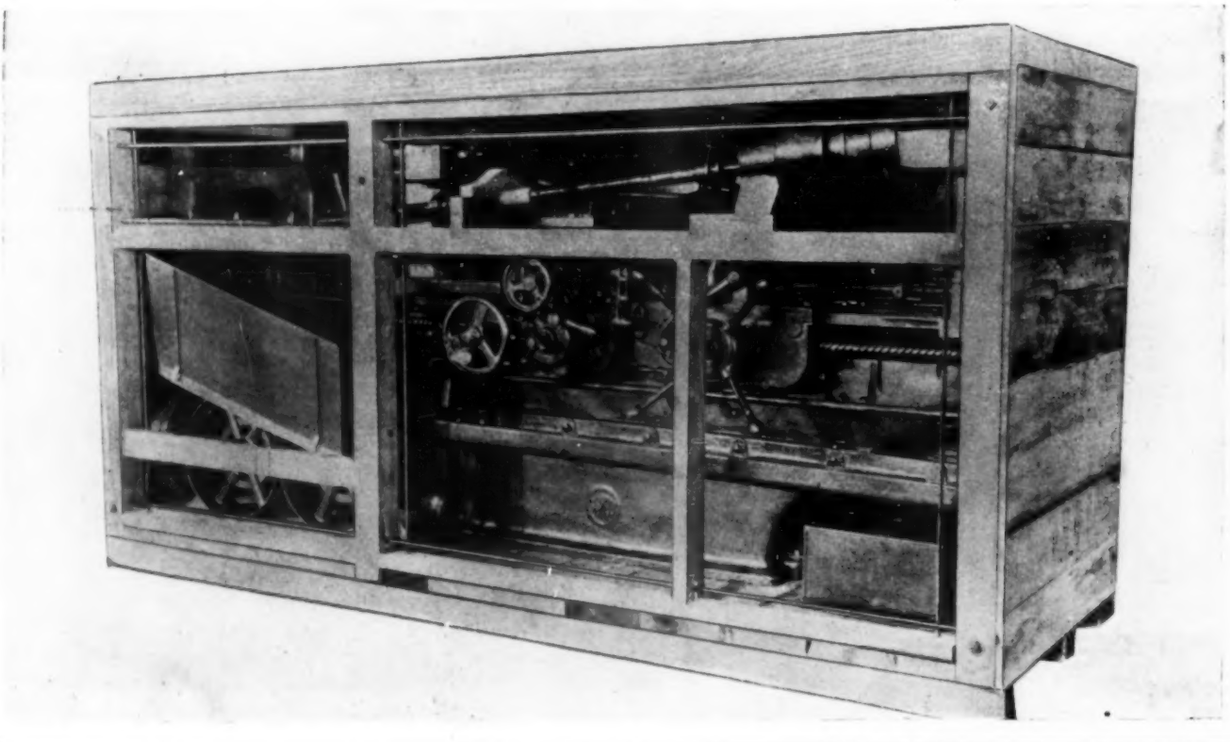


An Example of Secure Packing

Above—Crate frame for the Gisholt turret lathe. Note the steel tie rods

Below—Turret lathe and accessories in the crate ready for the siding

Photographs by courtesy of the Gisholt Machine Co.



The Impressive Story of Fiat

Manufacture of Ball Bearings

By J. A. Lucas and F. E. Bardrof

First of two articles on Fiat ball bearings — Machining operations on races for radial and thrust bearings—Hardening, grinding and polishing of races

BALL BEARINGS in great quantities and a variety of sizes and types are made by Fiat in the shops at Villa Perosa, located in the outskirts of Turin. These shops are shown in the view that appears as the headpiece of this article, together with a number of the workingmen's homes maintained by the company in this pretty suburban district. In addition to the making of ball bearings, these shops are also engaged in the manufacture of precision instruments, small tools and firearms, but the ball bearing industry is of particular interest since it is operated on a high-production basis and utilizes a considerable amount of ingenious special and automatic machinery.

We are fortunate in being able to present a number of photographs and sketches that illustrate the methods used in the manufacture of these bearings and we will endeavor to give a fairly complete outline of the entire process in this and the following article. The usual types of bearings are produced by Fiat, including the radial, the thrust, and the combined radial and thrust types. The bearing components consist of the races, the balls and the ball retainer or separator.

The races for radial bearings are machined from a solid rod or from tubing, the latter form being used when a large number of races of the larger sizes are to be produced, although the bulk of the races are cut from the solid rod. Fig. 1 shows a Gridley automatic engaged in this work, all the rings below 100 mm. in diameter being made on these machines.

Both inside and outside races are machined from the bar at the same time. A longitudinal hole is first drilled in the bar, which is then faced and turned by the side-head tools. This sequence of operations forms a roughly finished, heavy tube on the end of the bar, and the so-called spacing tool then cuts an annular space in the wall of the tube, leaving two concentric rings attached to the bar. These rings are then cut off, and rough-finished material for a pair of inner and outer races has been produced. Potter & Johnson semi-automatic lathes are used in machining the larger rings from tubing, one ring being produced at a time.

Ring-Shaped Cutters for Grooves

The rings are then chamfered on special lathes and the outer rings are chucked on a turret lathe, as shown in Fig. 2, where the groove for the balls is cut. The body of the cutting-tool is a ring, the outer surface of which is carefully ground so that a radial section will have the exact profile of the groove to be cut. A cutting edge is produced by grinding a sector from the body of the tool, and further sharpening of the tool makes no change in the profile of the cutting edge. The inner rings are mounted on a mandrel, several at a time for this operation and the same type of tool is used. One operator has charge of several grooving machines and is provided with gages for checking the work from time to time.

Grooves for admitting the balls to the bearing at assembly are milled on special machines illustrated in Figs. 3 and 4. The rings are held in a vise which is equipped with V-shaped jaws and fastened to the carriage. The vise is clamped by a quick-acting eccentric lever and the feed is disengaged automatically where the cutter has reached the proper depth. The

This is the second article of the Fiat series. The first article was concluded on page 607, Vol. 6, No. 17.

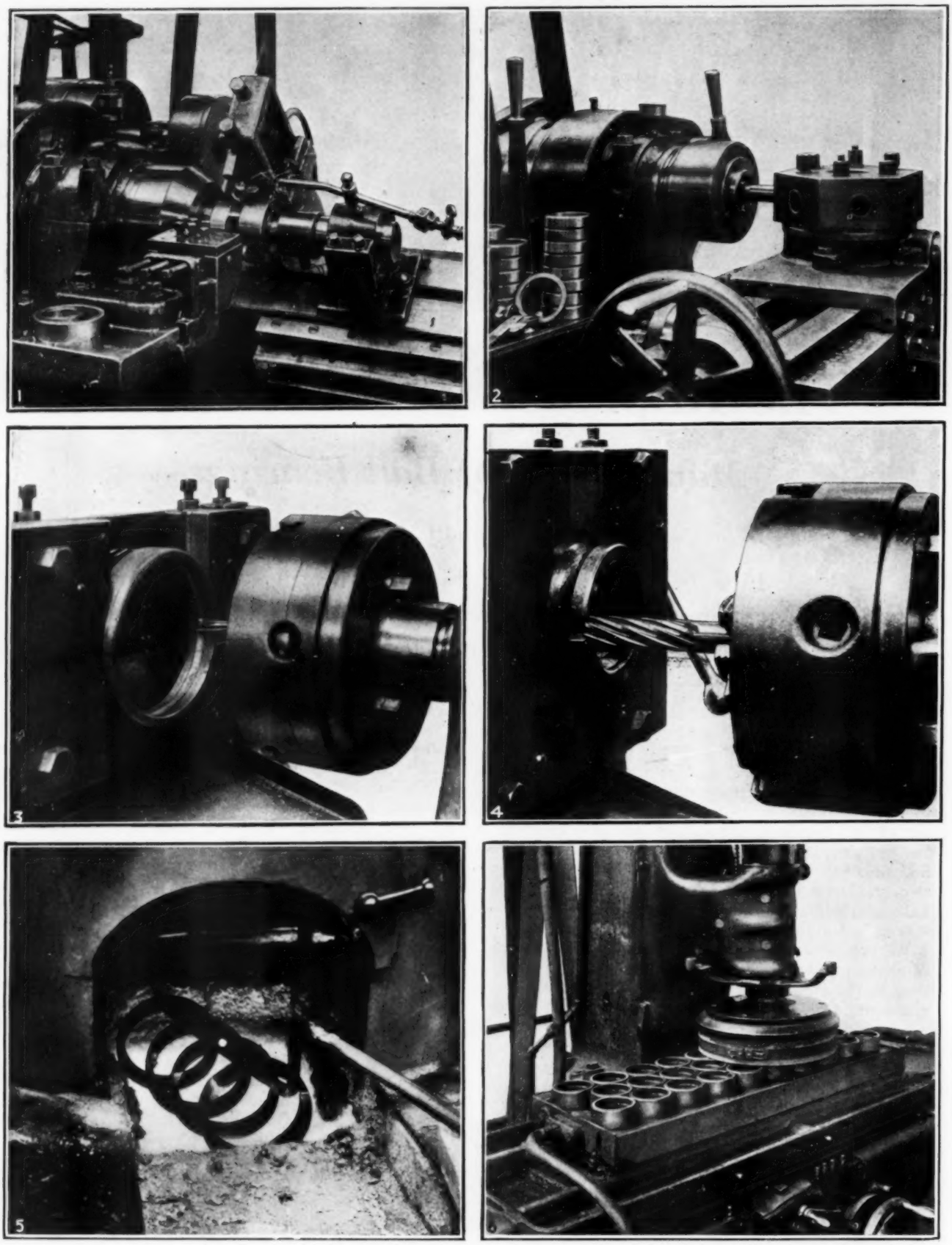


Fig. 1—Gridley automatic making rings for races. Fig. 2—Cutting ball groove with annular tool. Fig. 3—Ball entrance groove is milled in outer race. Fig. 4—Machining ball entrance groove in inner race. Fig. 5—Salt solution hardening bath. Fig. 6—Pratt & Whitney machine rough grinding edges of races.

races are now ready for hardening and grinding, but are first sent to the inspection department where they receive a most careful and rigid inspection, after which they are stamped and sent to the heat-treating room.

The heating of the races for the hardening process was formerly accomplished in ovens heated by naphtha, but these ovens have now been discarded in favor of an electrically heated salt bath, shown in Fig. 5. This bath consists of a mixture of barium chloride and potassium chloride in the proportion of 3 to 1 by weight, and is held at 850 deg. C. by an electric current of low voltage. The time of immersion is accommodated to the various thicknesses of races and varies from one to two minutes, being determined exactly by testing the hardness and brittleness of a percentage of the rings in process. Guided by this test, the lot of rings are heated in the bath for the predetermined time and then quenched in oil, where they are left until cold. The oil for the quenching bath is cooled and kept at a uniform temperature by circulating it continually around copper pipes through which cooling water passes. After hardening, the parts are cleaned in warm soda water and tempered.

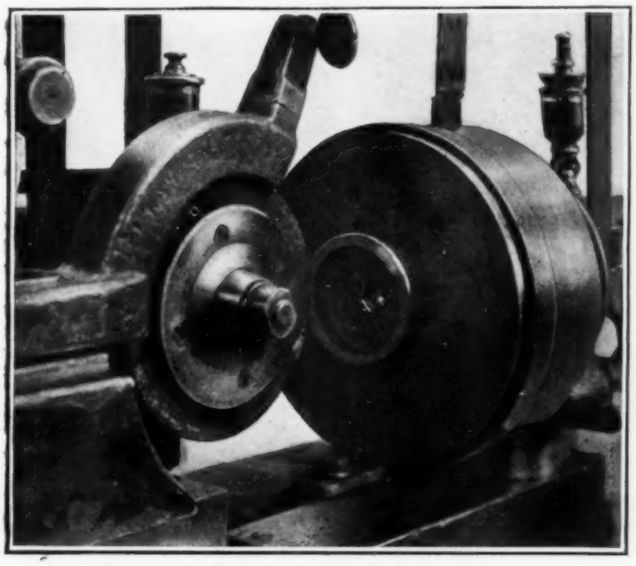


Fig. 7—Finish grinding edges of races

The tempering is done in an oil bath, in which the races are immersed for from 15 to 30 min., the temperature of the bath being held at 130 deg. C. The races are then ready for the various grinding and polishing operations.

In Fig. 6 a Pratt & Whitney machine is shown in which a number of outer races for double-row radial bearings are being rough-ground on the edges. The races are held in a magnetic chuck, the number ground at one set-up depending on the size of the races. The finish grinding of the edge is done as illustrated in Fig. 7, the work being held in a magnetic chuck and the pieces being ground one at a time.

The grinding of the bore of the inner races is shown in Fig. 8, the machine illustrated being a product of the Pratt & Whitney Co. The method used to hold the race on the face plate is apparent. Fig. 9 illustrates the method of grinding the outside diameter of the outer races on a Norton grinder. In this case a number of races are mounted on a mandrel slightly smaller than the bore of the races. To avoid distortion the races are

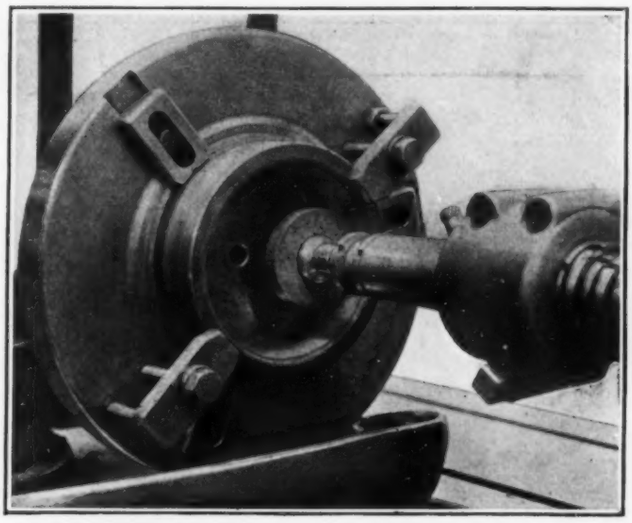


Fig. 8—Accurate grinding in the bore

clamped between two end rings and the mandrel simply serves as a connection between the clamping rings. The races are centered by means of two rollers mounted on the points of a V-shaped holder by means of which the operator crowds the series of parts into alignment, testing their concentricity by means of an indicator.

The machine illustrated is performing the rough-grinding operation, which is continued until the diameter is within a few thousandths of the required dimension. The parts are then transferred to another machine where the finish-grinding is completed with a fine-grain wheel and a fine feed. A very light finishing cut is taken so that the rings will not be distorted by the generated heat.

The method of rough-grinding the ball groove on an inner race is illustrated in Fig. 10. The race is mounted on a mandrel that just fits the bore and is clamped endwise as before to prevent distortion. The spindle rotates in fixed bearings and the wheel carriage as a unit revolves about a vertical axis that passes through the center of the arc of the ball groove. The rounded corner of the grinding wheel is located so that it re-

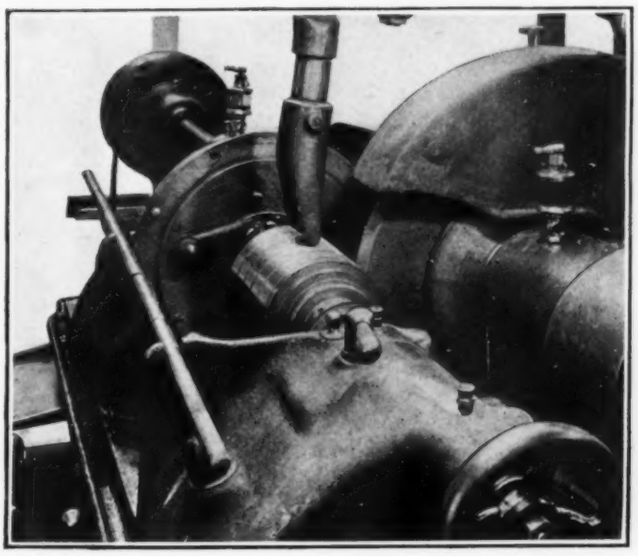


Fig. 9—The outside diameter of radial races ground on a Norton machine

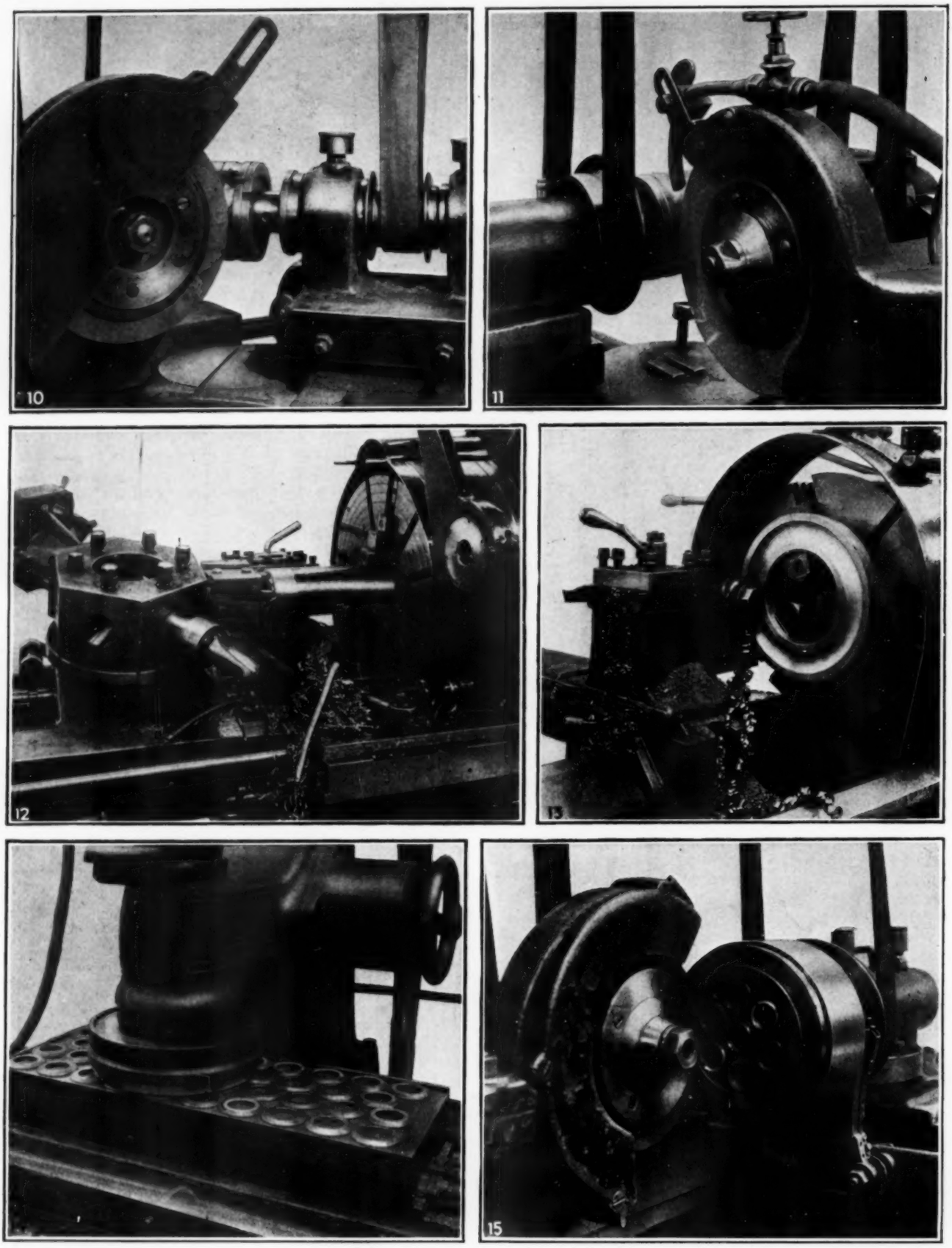


Fig. 10—Roughing out the ball groove. Fig. 11—Finishing the ball groove. Fig. 12—Gisholt machine makes thrust races from solid bar. Fig. 13—Annular tool cutting groove in larger thrust race. Fig. 14—Face grinding thrust races on a Pratt & Whitney machine. Fig. 15—Finish grinding on thrust races

volves at a distance from the axis equal to the radius of the groove and, as the wheel unit is swiveled, a groove of the correct contour is produced. The finishing of the groove is accomplished by a wheel dressed to the exact size and shape of the groove as shown in Fig. 11. A fine-grained Norton wheel is used for this operation and, in fact, Norton wheels are used in practically all grinding operations at Fiat.

The grooves of the outer rings are ground in a similar manner and the grooves for admitting the balls are ground by hand on small wheels of the proper radius. During and after the finish grinding the races are

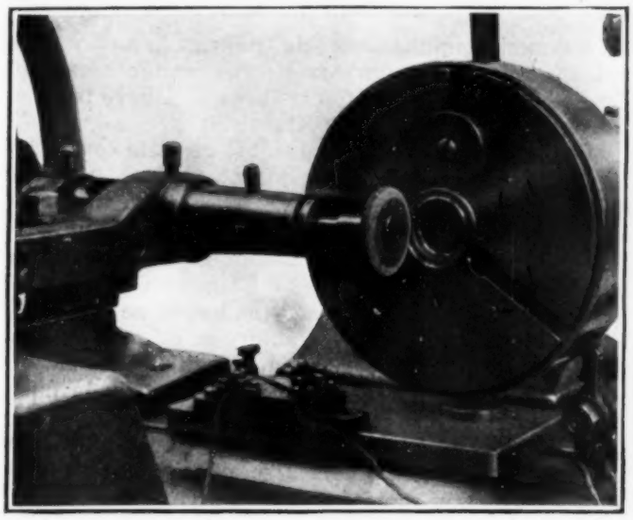


Fig. 16—The ball groove is ground by a small wheel

selected in sets and inspected by the aid of standard balls, after which they are polished on felt buffing wheels, and again undergo rigid tests for diameter, concentricity, and running qualities.

Races for thrust bearings are also cut from tubing or the solid bar, according to size, and Fig. 12 shows the machining of such races from a bar, the machine being a Gisholt turret lathe. The specific operation illustrated is the roughing out of the ball groove, the other tools in the turret including a drill for the center hole and a box tool for facing and outside turning. The large races are cut from tubing and the grooves

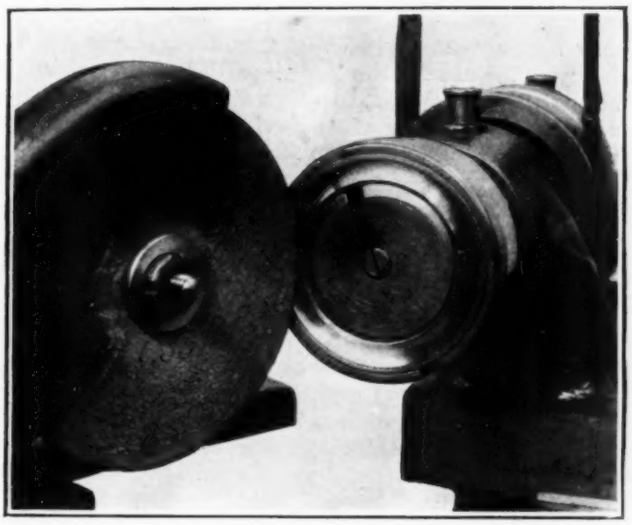


Fig. 17—Removing sharp edges from the ball groove

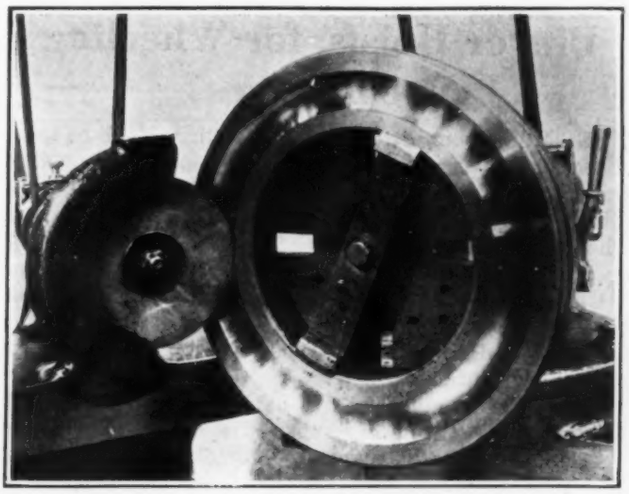


Fig. 18—Polishing a big thrust race

are then machined as shown in Fig. 13, employing the same style of tools as used on the radial races.

These races, after hardening, are rough ground on the faces as shown in Fig. 14, on a Pratt & Whitney grinder and the finish grinding is done as illustrated in Fig. 15. In each case the races are held in magnetic chucks.

The grinding of the ball groove for a small thrust bearing race is shown in Fig. 16, the wheel being dressed to the shape of the groove. A larger race is shown on the machine illustrated in Fig. 17, and the grinding wheel is removing the sharp corners of the ball groove. The race is mounted in a cupped faceplate and held by means of a slotted plate. The screw that holds the plate can be quickly released by a handle at the other end of the spindle. Fig. 18 illustrates the polishing of a large size ring.

Unnecessary Precision

By B. H. Blood
General Manager, Pratt & Whitney Co.

Precision in manufacturing is not a thing to be set on a pedestal and worshipped. It costs money and time. Where it is necessary to the proper functioning of a mechanism it is worth whatever it may cost. In most mechanisms which require close fitting there are but few critical dimensions which need to be held to close limits. For any manufacturing operation the tolerances given should be the widest which will assure satisfactory operation, but no wider. Anything closer than that is economically unsound. It is particularly unwise to place close tolerances on a drawing and then permit deviations by special dispensation. If work outside of established tolerance is usable, it proves that that tolerance is too close and should be widened in the interest of economy. Adherence to the established tolerances can usually be assured by correctly designed limit gages. The gages should be made inside the limits but as close to them as practicable, first cost and maintenance both being considered. They should then be used as fixed limits. The "Go" gage should go and the "No Go" gage should not go, and no gage should be forced, otherwise its life will be short.

An excerpt from a paper presented at a joint meeting of the Engineers' Club of Philadelphia, Philadelphia Local Section and the Machine Shop Division of the A.S.M.E. at Philadelphia, Pa., on March 25, 1924.

Pits or Hoists, for Wheeling Locomotives?

REPORTS from several different railroads, all of them well known, give interesting information regarding the comparative costs of using pits, or hoists, for handling locomotives in removing or replacing driving wheels. Practice and costs naturally vary, depending on equipment and the class of locomotives handled.

One road reports an average cost of $60 when using the drop pit, and $14 when a hoist of the Whiting type is used. Judged from the experience of others, this is an unusual difference.

Another road gives the cost as $30 for the pit and $18 for the hoist, still a very substantial saving, when used in connection with 10-wheel locomotives, with 20-in. cylinders, 63-in. drivers and weighing from 40,000 to 50,000 lb. on drivers. The executives of this road feel that the use of the hoist will save about 50 per cent as compared with the pit method.

The master mechanic of one road is strongly in favor of the hoist method and does not feel that a drop pit has a place outside of a roundhouse. Even there, he favors the hoist where the roundhouse is built high enough to allow the locomotives to be raised sufficiently to get the wheels out. He estimates that the work can be done in one-third the time with a hoist.

The fact that conditions vary widely, and that no one equipment is always the best, is brought out forcibly by the superintendent of motive power of a large road. In his opinion, the first consideration is the capacity of the shop and the force available to turn over the use of the pits rapidly. If the schedule calls for two locomotives per month for each pit, he feels that the hoist would be advisable, as it would release the overhead cranes for other work. Otherwise the frequent demand for crane service would interfere with the handling of shop work.

Where Cranes Are Better than the Hoist

In a shop where the locomotives are not handled so rapidly, a high-speed crane of small capacity, for use in connection with a heavy-duty crane, would, he believes, render the use of a hoist inadvisable. This official still believes it is necessary to have pits under the locomotives, even in the back shop, in order to make it more convenient and more comfortable for the men to work. Men can handle the work more expeditiously when working in an upright position, but blocking to this height is not convenient in most shops.

In the roundhouse, this official considers that pits can be used to better advantage than hoists, especially in welding broken frames, and in removing one, or even two pairs of driving wheels. Then, too, there is not so much money tied up in equipment.

The opposite opinion is held by the superintendent of motive power of another large railroad. He does not believe in drop pits, even in roundhouses. He uses overhead cranes in the main erecting shops, but has decided to install hoists in roundhouses whenever it may become necessary to make extensive repairs to the existing drop pits.

One other railroad executive considers the cost figures given in the first instance as approximately correct, and feels that hoists are highly desirable where only a comparatively few locomotives are to be handled, because of their utility and low first cost as compared with cranes. On the other hand, he feels that the cost of overhead cranes is justified in any fairly large shop, as the cranes can be used for so many purposes beside that of wheeling locomotives. The drop pit is not, in his opinion, at all necessary in any back shop, but is strictly a roundhouse facility.

These opinions probably give as good a cross-section of present ideas regarding methods of handling locomotives as can be obtained. But we shall be glad to have further information on the subject.

Co-operation

By John Thomas

In summing up the desirable qualities in men we are apt to overlook one which to the writer seems to deserve a place near the top of the list. I have in mind the ability to "get along" with others.

We imagine at times that because of their commanding position really big men do not need this quality quite so much as some of those lower down the scale, but when we examine their ways more carefully we find that the more tolerant a man is of the opinions of others—the more ready to hear both sides of a question—the bigger he is and the longer he lasts.

Some men with little real ability in other directions are able to accomplish much more with the same organizations than another who may be really brilliant but who lacks the quality of co-operation or of inspiring co-operation in others who may be working with him. In fact this quality is so necessary to success that we may say there can hardly be any real success without it.

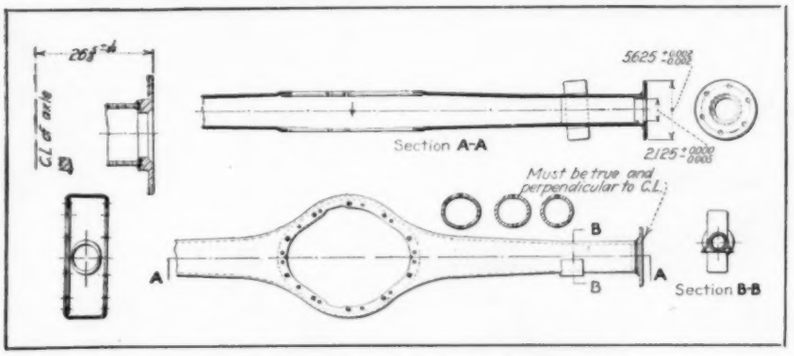
We all remember the old-time foreman who ruled by fear alone, and who knew little and cared less about co-operation; what little of the latter he secured was by main force. His type has almost entirely disappeared, and his passing has been brought about by simple evolution. The old methods did not produce the best results. In these days we must have co-operation, and our leaders must be men who can and will inspire that spirit. The man who imagines that to have a thing done right he must do it himself has the wrong mental attitude toward his fellow men and belongs to an age that is past.

One phase of non-cooperation is the failure of individuals to bring out ideas of their own that may be of benefit to their employers, and the reason for this may be the tendency of others to claim credit, or the failure of the employer to place the credit where it belongs. Many men are diffident about bringing out a new idea because of the criticisms and objections with which it is likely to be met. Frequently such criticisms are merely snap judgments, without reason behind them, and are often inspired by jealousy. Money saving ideas are rare, and any that are brought forward should not be discouraged or discarded without fair judgment.

No doubt the spirit of co-operation, like charity, should begin at home, and we should inspire co-operation by practicing a little more of it ourselves. The golden rule is a great help. Some people seem to think that this rule has no place in business, but it certainly has worked well in some instances, and, very likely, would work as well in a great many more if given a fair opportunity.

Let us be a little more considerate of those around us and we shall see that it pays in dollars and cents.

PRESSED steel has made possible the use of a light and strong axle housing. Some details are shown herewith. The flanges are welded to each end after the halves of the housing have been welded together. The spring pads are also welded in place.



General dimensions of rear axle housing

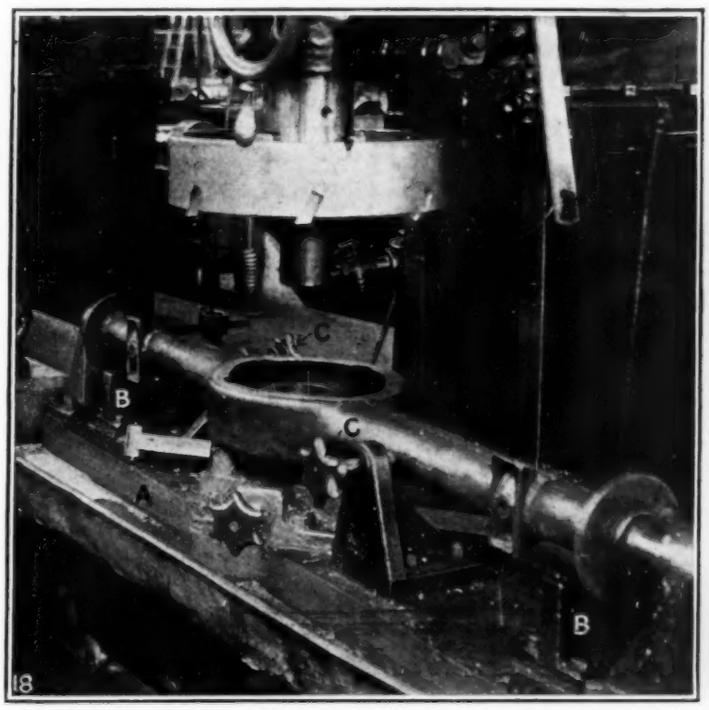
Maxwell Methods in Making Rear Axle Parts

By Fred H. Colvin
Editor, *American Machinist*

Third article—The rear axle housing and drive pinion—Fixtures used in production—Grinding two diameters at once—Special mounting for the truing diamonds

THE Maxwell rear axle housing is of sheet metal, pressed and welded into a light but stiff support for the rear-axle assembly. Fig. 18 shows one of a battery of Baker heavy-duty drilling machines, rigged up with special fixtures for facing the large flange which holds the differential housing.

The table of each machine has a deep pan in which is a substantial fixture having a heavy base *A*; centers at each end; supports *B*, near the flanges; stop or thrust screws at *C*, to take the side thrust of the facing cutter on the work; and supports under the center; all operated by the handscrews shown. The cutter has widely spaced teeth and the arbor is provided with a pilot to steady it during the cut and prevent chatter.



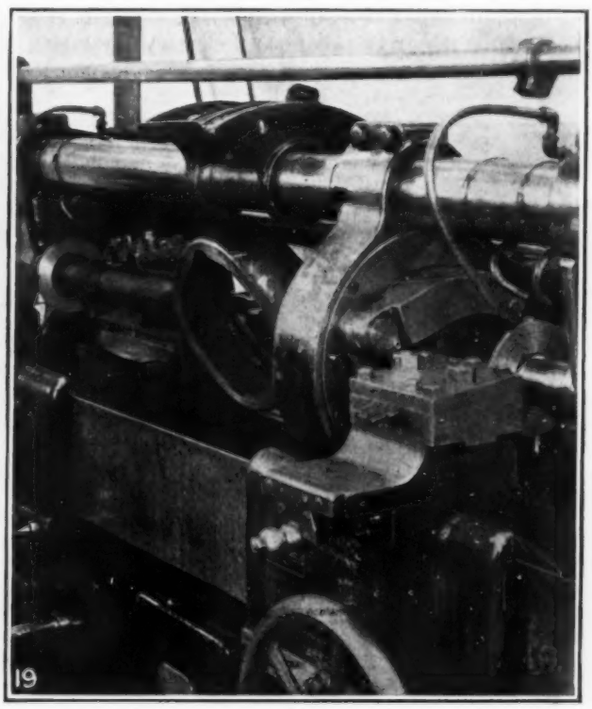
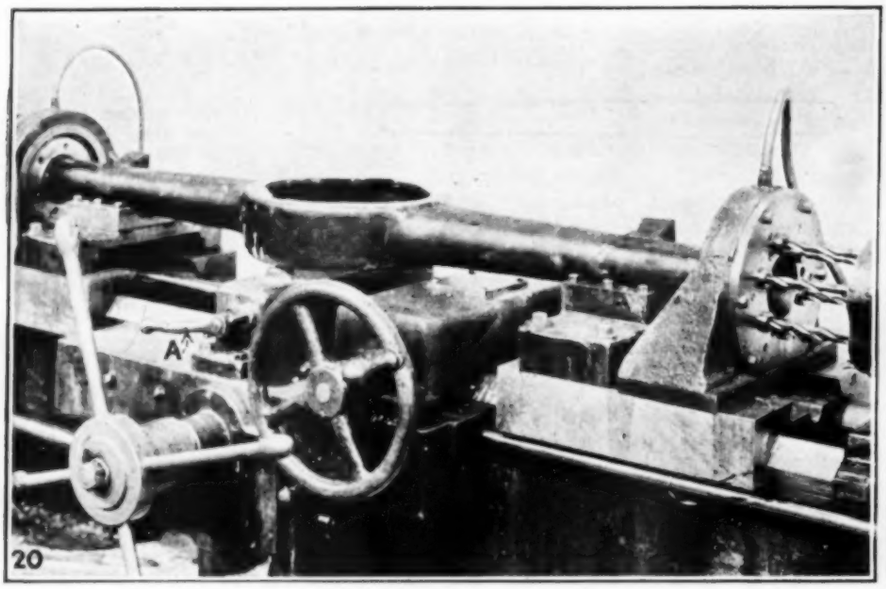


Fig. 18—Facing large flange on rear axle. Fig. 19—Turning both end flanges at once



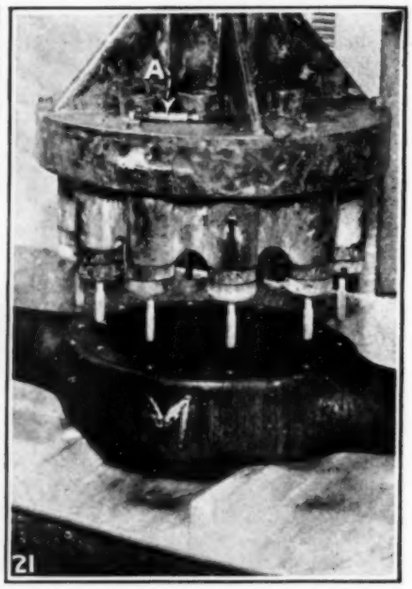


Fig. 20—Drilling both end flanges. Fig. 21—Tapping ten holes at once

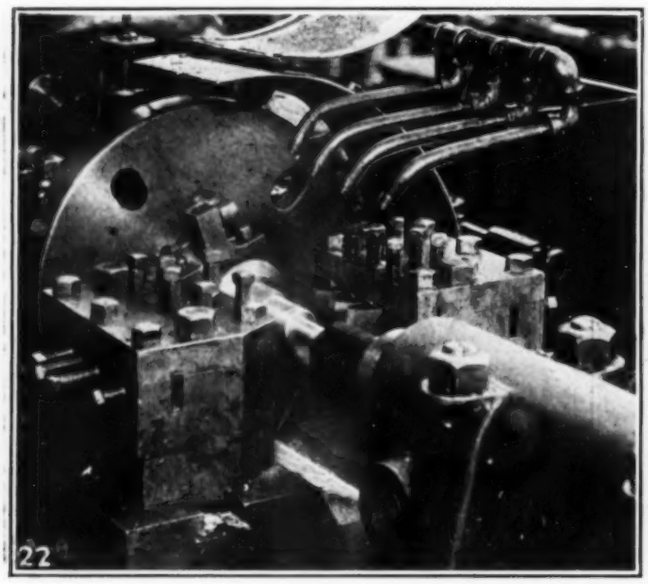
Another special set-up is shown in Fig. 19, in which the axle is having the end flanges turned in a Sundstrand lathe built for this purpose. Both flanges are turned simultaneously by tools held in rigid toolblocks. The housing is driven near the right-hand end by a special driver, operated from the rear by gearing. The driver grips without springing the work and takes care of any eccentricity in the housing. In this operation the outside diameters of the flanges are turned, and faced to the required thickness.

Drilling the end flanges is done on a Fox machine of the horizontal type, as indicated in Fig. 20. The machine is double ended and has fixtures, or chucks, which support the end flanges and also carry the drill bushings. There are also two central supports, which level the flanges receiving the differential housing, and so insure the location of the holes with relation to the squareness of the central opening. The leveling supports are operated by the lever *A*. The drills are flooded with cutting lubricant through the flexible tubes shown at each end.

After the holes are drilled for the studs which support the differential housing, they are tapped at one end with the special head shown in Fig. 21. The housing is supported by the parallel strips under the central portion, so as to insure the holes being tapped square with the face. The holes are gaged by the go and no-go plug shown on the tapping head at *A*.

While not all of the operations on the rear axle housing are described, the ones given herein are sufficient to show the type of equipment used, including machinery especially adapted for the work to be done.

Some of the operations performed in machining the rear-axle drive-pinion, show very clearly the modern tendency in machine equipment in a number of ways. Three different types of machines are used in as many



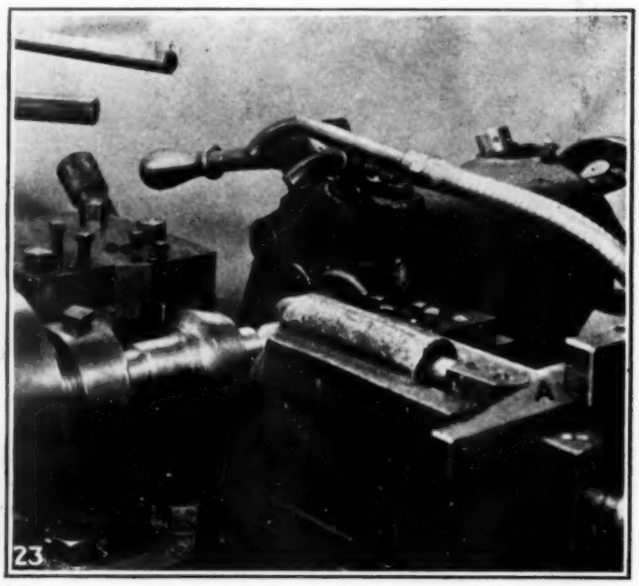


Fig. 22—Roughing pinion on Wickes lathe. Fig. 23—Finish turning on the Lo-swing

operations. The rough turning is done on a Wickes lathe as shown in Fig. 22. The small diameter, rigid type of driving dog; the solid tool posts with tools grouped and supported with but little overhang; the large center, flattened to allow the close approach of the toolposts; and the four streams of cutting lubricant, all proclaim modern methods.

For finishing the pinion, the Lo-swing lathe, equipped as shown in Fig. 23, has been selected. Here, too, the tools are closely grouped and well supported; ample

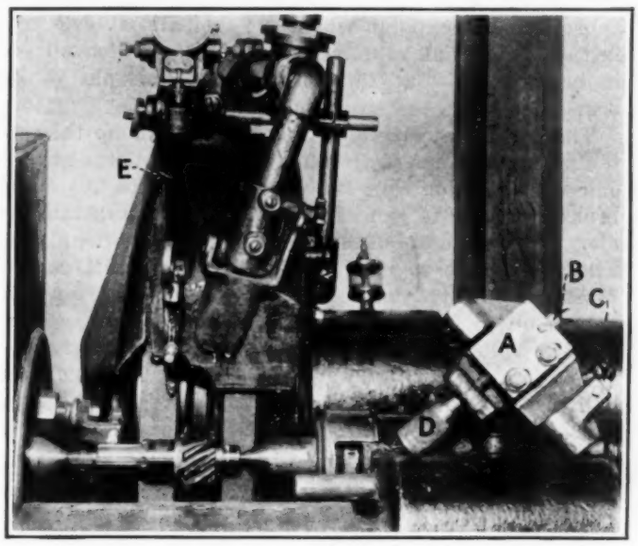


Fig. 24—Grinding two diameters at once

cutting lubricant is supplied, and the proper angle for the pinion is secured by the former *A* which controls the front turning tool.

The grinding method is decidedly modern, two different diameters being finished at the same time by the use of two grinding wheels properly spaced, as shown in Fig. 24. The wheels have no traverse, but are fed straight in. At *A* is the wheel dresser carrying two diamonds, one for each wheel. The diamond at *B* is for dressing the left hand wheel which grinds the larger diameter, while the one at *C* is for keeping the other wheel in trim.

The diamonds are set to secure the correct diameters on both wheels and the micrometer at *D* allows very fine adjustments to be made. The diameters of the work are automatically gaged by the Pratt grinding, or gaging caliper shown at *E*. The diameters are afterward checked by go and no-go snap gages.

Do You Advertise in England?—Erratum

By James Tate

There is one slight inaccuracy in the list of British terms in the article on p. 428, Vol. 60 of the *American Machinist*, that is, that a monkey wrench is a spanner. It is, undoubtedly, but it is more—it is a "shifting spanner." A spanner is a wrench, a large wrench, although there is some difficulty in determining just where wrench sizes end and spanner sizes begin. In some localities in the British Isles the terms are interchangeable for all sizes down to about ¼ inch.

A spanner for a round nut with radial holes drilled in its periphery is a pin spanner.

An English Apprenticeship of Thirty Years Ago

By Arthur Silvester

NOTING your editorial upon boys and the machine industry in a recent issue of the *American Machinist* I am led to reflect upon the days of my own early experiences in Birmingham, England, now more than thirty years ago, and to wonder if the conditions of that far-off time cannot ever be re-applied to revive the waning interest now displayed by the rising generation toward the trade that we used to call "engineering."

In my day the English shops were run upon what was called the "working charge hand" system, in which a senior mechanic would be given a piece-rate or sort of contract, under which he was to produce a certain number of parts or, perhaps, complete machines; and a number of boys and young men were placed under his direction to help him do the work. The charge hand was chosen not only for his skill as a workman, but much consideration was given as well to his character, judgment, and ability to teach others a knowledge of the trade.

He would have under his direction a crew of ten or twelve, made up of perhaps two full-rated men, three or four "improver" apprentices—young men of eighteen or twenty years of age who were well along in their course—and five or six young lads just starting in. The full apprenticeship course covered a period of seven years.

Boys who evinced a desire to learn the business were usually taken in by the firm on trial for the first three months, during which time they were under careful though inconspicuous observation by the foreman and the management. At the expiration of the probationary period the parents of the boys would be called in to execute indentures or to be told that their lad would probably do better in some other business, as the result of the foreman's watchfulness had dictated as to which of the boys were adaptable to the business and worthy of being perservered with.

Duties of Boys on Probation

During this preliminary period the boys were called upon to run errands, sweep the floors and perform various other minor but necessary duties that came within their capabilities. They were, of course, constantly associated with the men and, if they were of the right sort, were all the time absorbing knowledge of the machines and methods that would stand them in good stead when they became regular apprentices. They were assigned to help certain workmen, and were taught many simple operations of machining as well as the care and control of the machines.

By the time he had passed the trial stage and became a full-fledged apprentice, under the direction of his "charge hand," the boy would be capable of doing many ordinary jobs that did not require especial skill, and as his skill increased with his experience, the intricacy of the jobs entrusted to him was advanced accordingly.

The charge hand, being under contract conditions, was, naturally, desirous of getting all the work possible from his gang, but as a very large proportion of the work called for the manipulation of a trained mechanic, it was up to him to see that his boys acquired the

necessary degree of skill as rapidly as possible consistent with thorough training. It was a common sight in those days to see all the boys grouped around the charge hand while he explained or demonstrated how to make, grind or use some certain tool or how to do a certain piece of work to best advantage.

The more quickly and better a job could be accomplished, the greater the bonus to be distributed among the gang, and thus was established a motive, both for the charge hand to make expert workmen of his boys and for the boys themselves to do their utmost to excel. A friendly rivalry between gangs to see which would get out the most or the best work in a given time furnished a further incentive to physical and mental effort.

The manager, who had himself "served his time at the trade," took a fatherly interest in the boys, kept himself posted as to their welfare and advancement, and frequently questioned them as to how they were getting on; thus showing his own interest in them and thereby engendering a spirit of loyalty and a desire to win his approbation that is too conspicuous in these later days by its absence.

When a boy had completed the period allotted to the machine shop he would be required to pass a test, consisting of some intricate machine part that he would be expected to bring to completion unaided. Until this test, which usually involved the cutting of a multi-start square thread, was satisfactorily undertaken his education was not considered complete. After passing the test successfully he was sent into the pattern shop for six months and thence to the foundry for a similar time. He would then go into the drawing office for a period of eighteen months or so.

Ordinarily his time in the drawing office was completed about six months before the expiration of his term of apprenticeship, and the remaining time he would pass in the various departments of the shop as an all-round workman—a title to which he had by this time legitimately attained.

The time of a boy's "coming out" was generally the occasion for a little jollification in which the whole shop from the manager to the latest apprentice took part. The graduate apprentice was usually a fully competent, trustworthy mechanic and a good citizen, with none of the spirit of unrest and dissatisfaction that is so prevalent in the world of labor today.

Piston Rods on the Santa Fé

By Clifford H. French

The Santa Fé has standardized its practice regarding piston rods by specifying chrome-nickel steel, of A.S.T.M. specifications, A-63-18, class K, for superheated locomotives of the larger classes. When the rods are worn to the minimum limit, they are *turned* down for use in smaller locomotives. Alloy steel rods are not forged or heated in any way.

Piston rods for smaller locomotives are to be made from rods of larger locomotives when they are available for this purpose. When they are not available, steel axles may be used. In making piston rods from carbon steel from either source, the rods or axles are to be forged down to the smaller size, before turning to the proper dimensions. The forging improves the quality of the material and carbon-steel rods are not to be made by turning down larger rods without first forging them.

Motor Shop Problems

Fitting the Piston Pin

By Frank C. Hudson

THE PISTON pin is a simple and insignificant looking article but it plays a mighty important part in the performance of a motor. The pin itself is approaching the point which we can almost call perfection. Material, roundness and finish now leave little to be desired. But the fit of the piston pin in its bearing is still a real problem.

The great majority of motor builders clamp the piston pin in the connecting rod and let the pin bear at each end in the piston. In the case of cast iron pistons a bronze bushing is generally used. But with aluminum alloy pistons the pin usually bears directly in the piston. The problem is to have the pin fit so that it can be assembled and yet not be too loose when the piston gets heated up to its maximum temperature.

For, while the pin only moves a small part of a revolution, it takes the first wallop of the explosion and a little looseness, from wear or otherwise, soon makes itself evident. The sizes of piston pins have been increased in many cases, which gives them a longer life, but it also adds to the weight, which is one of the things we are trying to get away from in reciprocating parts.

In order not to have the pin fit too loose when the piston gets warmed up, some motor builders heat the alloy piston in hot water just before assembly. This expands the hole and the pin is pushed into place while the piston is hot. When it cools, the fit is very snug indeed but the working temperature gives it all the clearance necessary for the oil film, usually due entirely to the spray from the crankpin bearing.

The piston pin bearing is generally the one vital motor bearing that is not adjustable. There is one exception that I know of, and this has not yet been announced. In all other cases it is necessary to take off the connecting rod cap and remove the cylinder head, or, in the case of solid-head cylinders, to pull the whole cylinder, to inspect or renew the pin, or bushings.

The adjustable piston pin bearing has been cussed and discussed many times but heretofore no one has felt justified in putting it out in actual service, and for several reasons. The adjusting must be done from the inside of the piston. This means either that the piston and connecting rod assembly must be removed from the motor or that the adjuster must use special long wrenches and work from underneath, "puggling" up beside the connecting rod, and always practically in the dark. For it is next to impossible to throw any light up inside a piston under such conditions.

It seems hardly possible that any satisfactory adjustment of a piston pin bearing can be made without taking the piston assembly out of the motor, where you can "feel" the fit. And when this is done most engineers believe that it is better to put in a new pin and new bushings, rather than adjusting mechanism.

Then, too, there is the problem of adding weight just at the point where we are trying to reduce it. I'm not saying the perfect adjustable piston pin bearing may not be developed. But I'm perfectly willing to let the other fellow try it out in his motor first.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Standards, or Rules, to be Followed in Making Wooden Patterns

BY M. E. DUGGAN

Some time ago I had an article in the *American Machinist* in which I contended that there is no standard or set rule to be followed in the making of wood patterns, and a brother patternmaker from 'way over in England came back at me through the same medium and said he was "surprised at my assumption" (meaning, perhaps, presumption).

Now, I can assure the good brother that there is no occasion for surprise. I have spent about forty-five years in the patternmaking trade and am still an amateur. The corners of my tool chest are all battered up from moving about from shop to shop—moves sometimes urgently suggested by the boss patternmaker, because of my honest endeavor to follow a standard in the making of patterns rather than "doing, when in Rome, as the Romans do." I do not mean to imply that all patterns should be made with "buck-saw and axe." If a well finished pattern is wanted and you are so instructed, *make* it, by all means; but if a break occurs in the machinery and a new pattern is required for a repair casting, make it "with buck-saw and axe" if necessary.

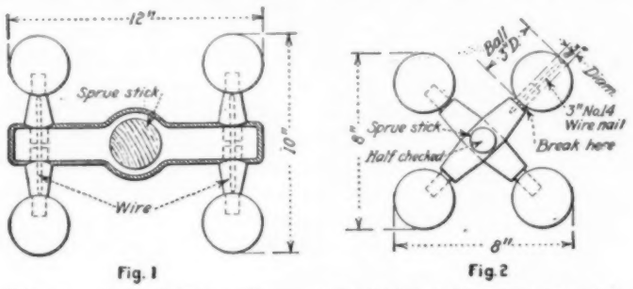


Fig. 1—An artistic pattern that did not last out the job.
Fig. 2—The "buck-saw and axe" pattern that finished it

In an emergency of this kind, it is a repair casting that is wanted, not a parlor ornament, and success goes to the man who knows how far he can disregard set rules and regulations, and still make a pattern that will answer the requirements of the foundry. Such a man must know molding and coremaking as well as patternmaking.

I have been on my present job fourteen years; not because of my ability to follow set rules and regulations in the making and finishing of an artistic pattern, but because I can furnish a pattern that will enable the foundry to get out the repair casting in case of a breakdown in the shortest possible time. "I don't give a —— what kind of a pattern you make," says the boss; "what I want is to see the wheels turning."

Please understand that I am not trying to encourage the buck-saw and axe method of patternmaking, but to the young man who is learning the trade I will say: "Don't tie yourself to any so-called standard. Learn how to produce the fine stuff when necessary, but at the same time, learn where and how far you can disregard the rules when the emergency arises, and a casting to meet the necessity must be made in a rush."

Here is a bit of an example—just to make the story interesting. The pattern shown in Fig. 1 was made to fill an order for 250, 2½-in. and 250, 3-in. balls of cast iron. The pattern was an artistic bit of work, made up of pine lumber with nicely glued joints, but it came apart before the order was half completed. The job was a "rush order" and to finish it on time, a plain cross-gate pattern, Fig. 2, was made of maple, cut and shaped on the band saw.

The job reminds me for some reason of the story of an Englishman and an Irishman who were passing by the Woolworth building one evening. "Fine piece of work," says the Englishman; "How long did it take to put it up."

"Don't know," responded Pat; "It wasn't there when I passed by on me way to work this morning."

Bronze or Babbitt for Camshaft Bearings

BY J. F. REYNOLDS

The writer is not desirous of calling down upon his own head the anathemas of the motor builder or expert, or even of starting a discussion as to the relative merits of bronze and babbitt as bearing materials; he merely wishes to record an actual happening.

In pre-war days our company undertook the manufacture of a redesigned Knight motor which was quite new to our line. The camshaft of this motor ran in bronze bearing bushings that were pressed into place in the crankcase casting and line-reamed in position. Because of the difficulty of getting all the sand and grit out of the new castings it sometimes happened that after the block test these bearings would be so badly cut and grooved as to necessitate renewal.

One day the stock room was unable to furnish replacements of this item immediately, and to keep the work moving the bushings were pulled, chambered out about $\frac{1}{8}$ in. deep with a narrow shoulder at each end to retain the babbitt, and the chambers filled with babbitt by means of a gas flame and a soldering copper. The bushings were then rough-bored, set back into place and line-reamed.

Unknown to us the manager had planned a publicity campaign under the supervision of outside men in which a motor was to be taken from stock, mounted on the test block and run under load for two weeks, day

and night. No authority had been given to put babbitt in the camshaft bearings, the management knew nothing about it, and, of course, the imp of perversity that presides over machine shops caused that particular motor to be selected for the test.

With fear and trembling the motor was mounted on the test block and put to work. After a perfect record of fourteen days continuous running it was dismounted and taken apart for inspection, upon which the camshaft bearings were found to be in perfect condition, with the reamer marks still showing.

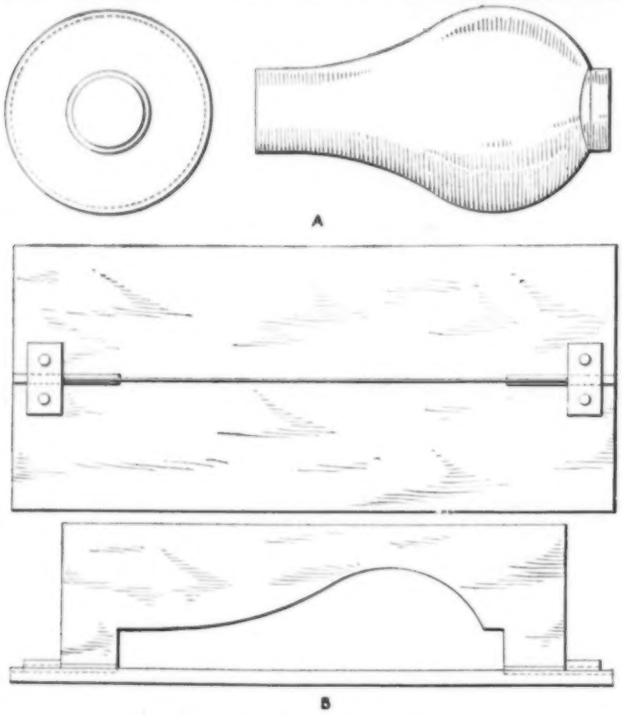
Means for filling the bushings on a commercial scale were immediately provided and babbitt-lined camshaft bearings became a matter of regular production.

A Sweep for Making Small Cores

By P. H. White

The sketch shows at *A* a hollow bulb of cast iron, having a very thin wall. A quantity of these castings was required and the job of making the cores was done with the sweep shown at *B* in the same sketch.

A sheet of steel was hinged to the center of a flat plate in such a manner that it could be swung from



A sweep for small cores

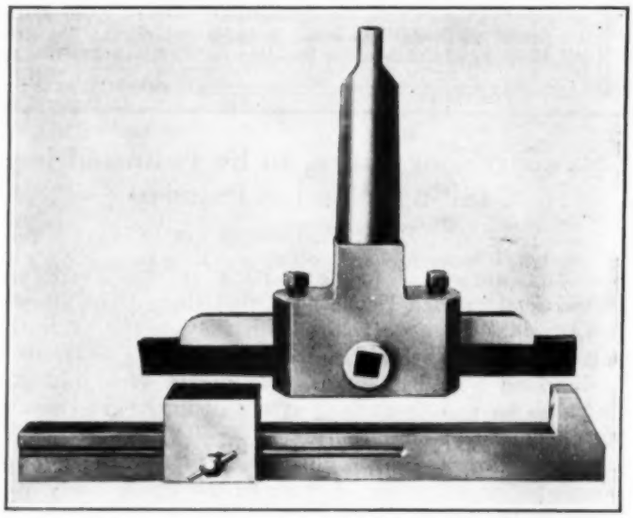
side to side through an arc of 180 deg. Next, the outline of one half of the casting was laid off on the sheet, with the center of the bulb coincident with the center of swing, and then a line paralleling the outline was drawn a sufficient distance nearer the center to give the required thickness of wall. The sheet was then cut and filed to the inner line.

The cores were made by packing sand on the flat plate, and swinging the sweep backward and forward, adding sand as was necessary until the full half-core was formed. After baking, two halves would be pasted together to make a complete core. We found these cores to be as accurate as could be made with a corebox and they answered our purpose very satisfactorily.

Boring Tool for Locomotive Work

By J. H. Hahn

The boring tool shown in the accompanying illustration was designed by F. H. Wicks, foreman of the tool room in the Portsmouth, Ohio, shops of the Norfolk



Boring tool for railroad shops

& Western Railway, for use in drill presses, horizontal boring mills, milling machines, etc., upon such work as boring the eyes in side rods, boring tail-bars, draw-bars or similar parts requiring holes of large diameter.

The cutters are adjustable over a reasonable range of diameter and are easily replaceable by others of different lengths for wider variations.

The gage shown with the tool is used to adjust the cutters for various diameters.

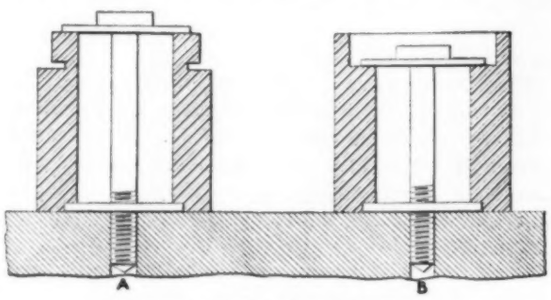
Improved Type of Toolmakers' Button —Discussion

By Harry S. Clark

The illustrations herewith are of toolmakers' buttons that I think are preferable to those shown by R. H. Kasper in his article, under the title given above, on page 28, Vol. 60, of the *American Machinist*.

The two-piece button shown by Mr. Kasper would never be as accurate as a one-piece button, no matter how carefully made.

The projection on the button shown at *A* is the same



Accurate toolmakers' buttons

diameter as the recess on the button at *B*, and both are the same overall height. Otherwise the sketches are self-explanatory.

Finish Marks on Drawings

BY ALBERT A. DOWD

The appearance of many otherwise good drawings is often very much injured by a lack of care in putting on "finish marks." The ordinary "*f*" is made in so many different ways that it sprawls all over the surfaces on which it is placed, and the different slopes of the letters tend to give the drawings an untidy appearance.

There is shown in Fig. 1, at *A*, a standard T-slot dimensioned in the ordinary way, and with finish marks

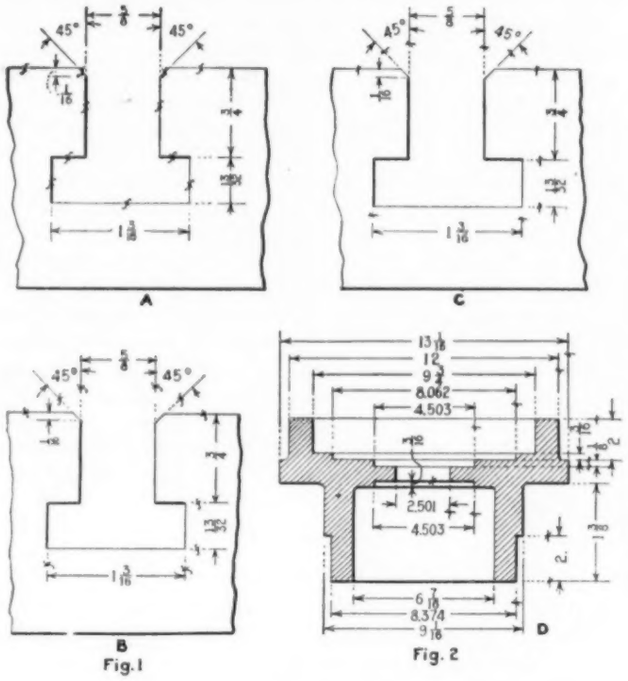


Fig. 1—Two methods of putting finish marks on drawings. Fig. 2—Author's method of putting finish marks on drawings

placed as they would be by the average draftsman. Due to the congestion of dimension lines, figures, and finish marks, the neatness of the drawing is greatly injured. The majority of draftsmen place the finish marks directly on the surfaces which are to be finished, and when there are a number of adjacent surfaces, the result is often unpleasant to the eye.

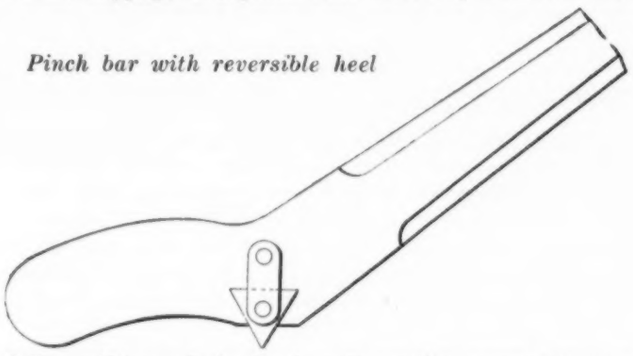
In the example at *B*, a different method is used, the marks being placed across the dimension lines, and not directly on the machined surfaces. There is a noticeable improvement in *B* over *A*, and yet the drawing still does not look as well as it might. An examination shows that this is largely due to the difference in angularity, size and general appearance of the "*f*" marks.

Two drawings dimensioned in the regular way, but with finish marks of slightly different shape and looking very much like an "X" are shown in Fig. 2. The marks are all placed on the dimension lines in symmetrical form, with one leg of the mark at right angles to the line and the other crossing it at an angle of about 45 deg. This style of mark is used on both *C* and *D* drawings, and the improvement in the general appearance is very noticeable after comparing them with those shown in Fig. 1. The drawings are both more readable than the others, both as to dimensions and portions finished.

Reversible Heel for Pinch Bars

BY G. CHARLES HOEY

Any mechanic who has experienced the discomfort of having been "stood upon his head," on the floor, due to the slippage of a pinch bar, caused by the worn and



Pinch bar with reversible heel

dull condition of the heel, will readily appreciate the value of the reversible and replaceable heel for pinch bars illustrated herewith.

It is not necessary to change the design of the present bars other than to machine off the forged heel, and to machine a dovetail slot to receive the hardened, triangular tool-steel heel.

The cross-section of the tool-steel heel is that of an equilateral triangle, which presents three wearing edges that can be used before the heel is discarded. A supply of hardened heels in the toolroom prevents the holding up of any pinch bar for repairs, for it is a simple matter to loosen the holding bolt, remove the bolt from the heel, slide the heel out, reverse it or apply a new heel, replace the heel bolt, tighten the holding bolt, and return the bar to service.

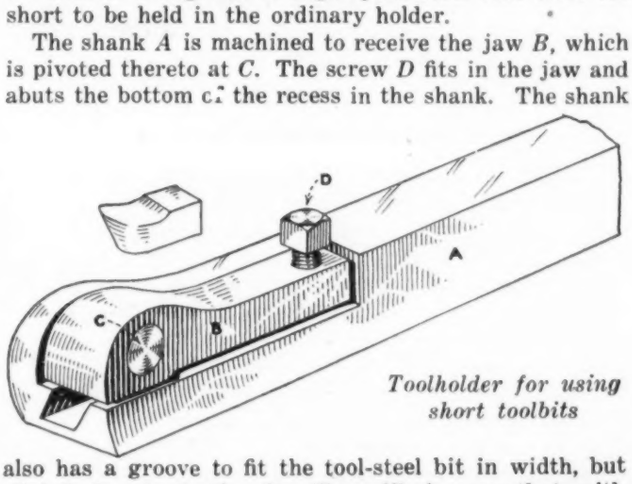
This appliance will save much time and blacksmith work, and is a strong "Safety First" tool.

An Economical Toolholder

BY F. L. LEWIS

The toolholder illustrated herewith was designed with the idea of using bits of high-speed steel that were too short to be held in the ordinary holder.

The shank *A* is machined to receive the jaw *B*, which is pivoted thereto at *C*. The screw *D* fits in the jaw and abuts the bottom of the recess in the shank. The shank



Toolholder for using short toolbits

also has a groove to fit the tool-steel bit in width, but slightly less in depth. It will readily be seen that, with the toolbit in its groove, tightening the screw will cause the forward part of the jaw to bear on top of the toolbit and hold it firmly. Such a toolholder will soon pay for itself by utilizing short toolbits that would otherwise be scrapped.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Historical Aspects of Machine Tool Designing

MALICIOUS gossip has always accused machine-tool designers of being historically inclined inasmuch as their designs often show the results of a close study of contemporary history as set down in their competitors' models. Machine designers who qualify as historians according to this definition do not attain any great measure of respect in the industry nor do they deserve it.

There are, however, two other historical aspects of machine-tool designing that must be considered by the designer if he is to succeed. In the first place he must study the various steps leading up to the latest developments in the tool upon which he is at work. Not only must he be familiar with the advances made by his own company but also with those of others making the same type of tool. Such knowledge is the best insurance against repeating mistakes in design made previously and later corrected. In other words, it helps to prevent "inventing downward."

But there is still another aspect of which account must be taken. There was a time when machine-tool builders were rather careless about patents. As a result many valuable ideas were lost to their originators. Times have changed and the infringer now finds the holder of a patent ready to protect his rights. Patent litigation is never pleasant and, in the vast majority of cases, results in profit to the patent attorneys alone.

The designer who, through ignorance, incorporates a patented feature in his machine is simply storing up trouble and expense for his company. In such cases the courts are not impressed by a plea of ignorance. The only safety lies in a full knowledge of the history of the art. It may take time and effort to get at all the facts but it is time well spent if infringement, litigation and ill will can be avoided.

Rational Standardization

IT WAS, of course, to be expected that the work for standardization would meet with opposition. Some people are so constituted as to oppose changes of every kind. There were probably many who objected to abandoning caves for better abodes and there are still a few who insist on key-winding watches, probably with special sizes of keys.

In the same way we find opposition to all kinds of standardization cropping up in various places and frequently from those who should know better. Just at present a few of this kind are endeavoring to brand the efforts of the various engineering societies as fads that will fail because standardization interferes with individuality, etc., etc., which is an old, old story.

There are, to be sure, a few fanatics who would standardize everything—if they could—just as others like them tried to carry various systems of scientific management to their "illogical" conclusion. The *American Machinist* opposed the extremists in management just as it now opposes similar extreme proposals of standardization. But rational standardization should and will have the support of every level-headed engineer and business man.

Those who complain at interference with individuality forget that the only man who can freely express his individuality is a Crusoe on a desert island. The minute a second individual appears, some of the first settler's individuality must be restricted. And restriction increases as towns, cities and countries grow larger. You might prefer a 20-ft. sidewalk in front of your house but if all the neighbors felt that one 10 ft. wide was sufficient, your individuality would go a-glimmering.

If anyone wishes to express his individuality by buying odd-sized tires, machines, bolts or windows for his house, he can always be accommodated—at a price. But the average man would prefer to use standard parts and secure the resulting saving in cost.

Mr. Hoover has shown us what can be accomplished in reducing the numbers of sizes of various articles. Such a reduction makes possible great savings in manufacture and the economic value of decreasing the large amounts of money tied up in huge stocks is evident. The *American Machinist* stands for rational standardization, realizing that those who advocate extreme measures usually defeat the end sought.

A Victory for Engineers

WHILE the Reclamation Service can hardly be considered as touching the field of the *American Machinist*, the juggling of its engineering personnel by the Secretary of the Interior has served to unite all engineers in defense of their profession. The dismissal of Arthur P. Davis met with a storm of protest from individuals and was made a sort of test case by American Engineering Council.

At last the determined attitude of engineers throughout the country, as brought to the attention of political Washington by American Engineering Council, has resulted in a change of front. It has finally been proved to practical politicians that it is not only unwise but unsafe to entrust enormously complicated engineering problems and projects to others than engineers.

The country is to be congratulated upon the appointment of so eminent an engineer as Dr. Elwood Mead to head the Reclamation Service. The engineers are to be congratulated on their victory in their fight for vindication. They have shown that they are a force to be reckoned with when they take up the cudgels in a fight for what they believe to be the best interests of the country.

A manufacturer of drilling machines has gotten together some figures on repairs. He finds that in 1923 the average repair cost per spindle on the 7,600 spindles he has sold since 1908 was $1.98.

Here is proof that a buyer gets more in a machine tool today than he did some years ago—more life, more production. Incidentally—the repair parts were sold at a profit.

Shop Equipment News

Gould & Eberhardt No. 72-H Automatic Gear Hobbing Machine

An automatic gear hobbing machine, adapted to the cutting of gears up to 72 in. in diameter, has recently been developed by Gould & Eberhardt, Newark, N. J., and is now being marketed. This machine, which has been designated No. 72-H, is of the universal type arranged for automatically hobbing spur, helical, herringbone and worm gears of all sizes within the capacity of the machine, also for milling spur and helical gears and worms, by means of a semi-automatic disk cutter attachment incorporated in the basic design of the machine. The machine is rated for cutting up to 1½ diametral pitch in cast iron, or 2 diametral pitch in steel. Coarser pitches can be cut by taking roughing and finishing cuts.

A number of notable features are incorporated in this machine. All of the drive, feed and differential gearing has been segregated and assembled in a case, which is bolted to the rear of the bed of the machine, as shown at the right in Fig. 1. The advantage of this arrangement is the accessibility of the gearing, since the removal of the cover exposes the entire mechanism, but additional advantages are afforded in manufacturing, as this case may be machined easily and accurately as a separate unit. Assembling is facilitated and it is possible to incorporate an automatic gravity system of lubrication. From this case the drive shafts for the work and cutter spindles, the feed shafts for cutter carriage and stanchion, and the various control rods, all extend along the bed of the machine. The change gears for cutter speed, index, feed and lead are located outside of the case, but entirely enclosed by adequate guards.

Another feature is the application of an adjustable type of stanchion, which is arranged to slide on carefully machined ways on the bed. This design permits the use of an unusually long, slightly tapered work spindle, which is mounted in a large taper bearing, the bearing being held not in the frame, but in a heavy casting *D*, Fig. 2, which is securely bolted and doweled to the bed.

The index wormwheel at the bottom of the spindle is 48 in. in diameter and is machined from chilled semi-steel. The worm that drives it is of steel, hardened and ground, and is mounted on a short shaft inside the casing *G*, Fig. 2. The worm shaft is geared to the longitudinal index shaft *H* which passes into and through the gear case and is driven by change gears. By the use of proper index gears it is possible to cut gears with from 8 to 99 teeth, including the prime numbers, and from 100 to 312, excluding the prime numbers.

With this design, having the worm wheel in the base of the machine and not mounted on the top of the bed, it is possible to provide a worm wheel of much larger diameter than is ordinarily found in machines of similar size, at the same time making it possible for the machine to be used on small diameter pinions without having an extreme overhang of the cutter slide.

The spindle has a 10-in. hole through its center from end to end. It is therefore possible to machine gears that are integral with long shafts, since the shaft may extend through the floor if necessary. The diameter of the work spindle head is 21 in. and an auxiliary face plate

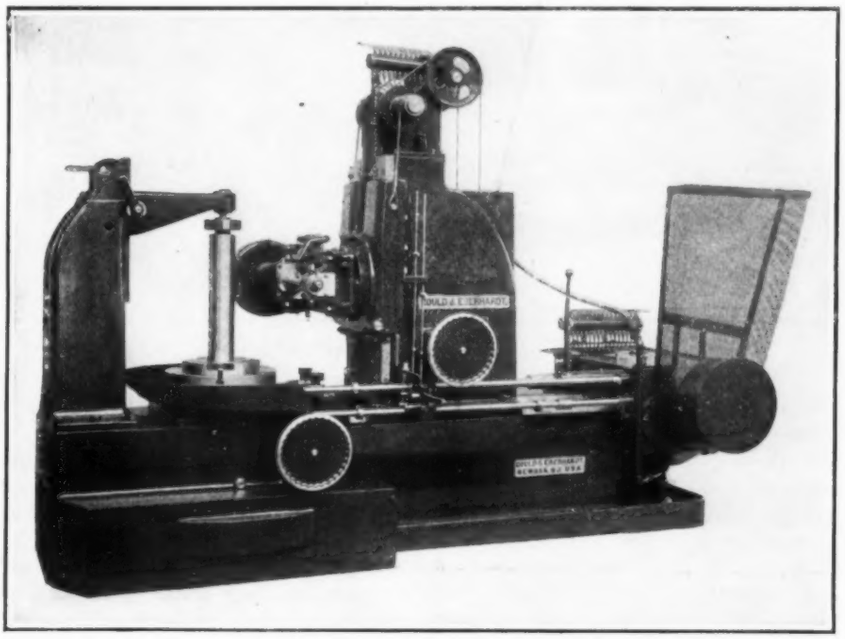


Fig. 1—Gould & Eberhardt No. 72-H Gear Hobbing Machine

36 in. in diameter is supplied to support gears of large diameter.

A suitable work mandrel is furnished, the upper end of which is supported by the box-section, stanchion-type outer support, shown in the illustrations. The bearing *E* is guided on the face of the support and the casting *F*, Fig. 2, is counterweighted so that it will slide up and down easily when unclamped. When the blanks are to be changed on the mandrel, the arm is moved up to the face of *F*, which is then unclamped and swung around, carrying the bearing and giving access to the top of the mandrel. The outboard support may be used when cutting gears up to 36 in. in diameter, and for

larger gears the support may be moved as an entire unit.

The cutter spindle is mounted in substantial bearings on the swivelled section of the cutter carriage, the bearings having independent adjustments for radial wear and end play. The outer or arbor bearing is removable for mounting the cutter and both bearings can be moved in an axial direction, a rack and pinion being provided to move the heavy inner spindle bearing which takes the thrust. This arrangement is especially valuable as a means for quickly centering the cutter or hob. A further aid for alignment purposes is a locating gage in a hole at the center of the carriage. This gage is normally flush with the carriage but can be easily projected a short distance from the hole when required.

The standard cutter arbor is 1½ in. in diameter and larger sizes can be used. The maximum diameter of hob which can be mounted is 11 in., with a maximum length of 16 in. The spindle is driven through herringbone gears from a parallel shaft, the gears being mounted in bearings and splined to the spindle, so that the spindle is not required to resist the thrust of the gears. A 16-in. flywheel is mounted on a stud at the end of the swivel slide and is driven by spur gears from the parallel shaft, so that it will rotate faster than if attached to the cutter spindle and can be made smaller in size.

The parallel shaft mentioned above is driven by a series of shafts and bevel gears inside the stanchion from the horizontal cutter drive shaft *A*, Fig. 2. This shaft runs through to the further end of the gear case where it is driven through change gears which provide 10 cutter speeds ranging from 20 to 97 r.p.m. The pulley shaft of the machine drives the change gear shaft through a reversing clutch, so that the direction of the cutter rotation can be changed at will.

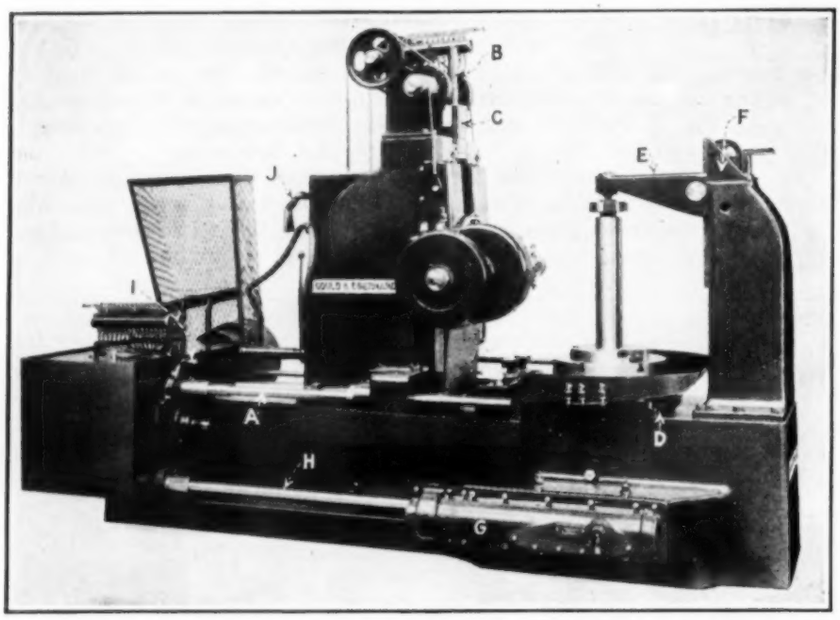


Fig. 2—Rear view of Gould & Eberhardt hobbing machine

The proper angular position of the hob is obtained by rotating the swivelling portion of the carriage, a worm and gear being provided for this purpose. The carriage has exceptionally long guide bearings on the face of the stanchion. The ways are rectangular in section to obtain the effect of a long narrow guide, and the carriage is provided with gibs. The feed screw *B* is fastened solidly in the carriage, the feed nut *C* being mounted in the stanchion at the top of the ways, where it is driven by a worm.

The carriage has rapid power traverse in both directions in addition to the power feed for cutting. A total of 10 cutter feeds are available and range from 0.01 to 0.15 in. per revolution of work spindle. The feed nut receives its power from a longitudinal shaft located between the ways of the bed, this shaft being driven through the feed gearing in the gear case. A sufficient feeding length for gears with face width of 20 in. is available.

Fixed and adjustable stops for both feed and power traverse of the carriage are provided, as shown in Fig. 1, and the control levers are in a convenient position. All control levers are interlocked so that the feed cannot be started until the rapid traverse is stopped, and the traverse cannot be started while the feed is engaged. The carriage counterweight system is provided with differential type pulleys so that the counterweights are comparatively light and require little space.

The index shaft *H* is driven from the cutter drive shaft in the gear case and, for hobbing spur gears and worm wheels, directly through the index change gears. When cutting helical teeth the proper setting of a clutch causes a miter gear differential to be introduced into the train. The casing of the differential has wormwheel teeth on its periphery and is rotated by a worm which is, in turn, driven through change gears from the cutter feed shaft. This gives the required lead for helical teeth.

All cutter and index drive gears are made from alloy steel and heat treated. This gives an accurate, smooth running drive and, together with other design features already described, provides a machine of exceptional accuracy and with freedom from chatter. All parts are of sufficient strength and rigidity for the service required.

When it is desired to use the disk cutter attachment for milling teeth, a proper setting of the index clutch and manipulation of the handle *I*, after shifting one gear on the shaft *H* just inside the gear case, allows the indexing of the work by hand for each tooth. The automatic cutter feed is used, and the proper lead for disk-cutting helical teeth may be obtained automatically through the differential.

The machine is driven by a single belt pulley through a friction clutch. The pulley is 16 in. in diameter with a 4½-in. face, and should run at 600 r.p.m. The clutch is controlled by the ball-end lever at the right of the stanchion in Fig. 1, and an expanded metal belt guard is provided. The coolant pump is geared directly to the pulley shaft and runs at constant speed, delivering the liquid at the cutting point through a flexible hose and a wide nozzle *J*, Fig. 2. The coolant then returns to a large reservoir in the base where it is settled and cooled.

Carpenter Disk Grinder

A recent development in disk grinders has been made by the Carpenter Engineering & Machine Co., 522 Corn Exchange Building, Minneapolis, Minn., and the machine now being marketed is shown in the accompanying illustration. The spindle is 2¼ in. in diameter and carries two abrasive disk wheels, revolving at 1,800 r.p.m. The spindle is mounted in Hess-Bright ball bearings.

The outstanding feature of the machine is the means provided for mounting the work table, by which the table height is adjusted and the proper feed and traverse of the work is obtained. It will be noted that the table is clamped at the top of a bracket which is mounted on a long stud or trunnion, and the bracket is swung on the trunnion to traverse the work across the grinding wheel. A heavy counterweight is provided to hold the table bracket upright and requires no adjustment for variations in table height or other adjustments. The bracket may be clamped to the trunnion, if desired, by a conveniently located clamp handle.

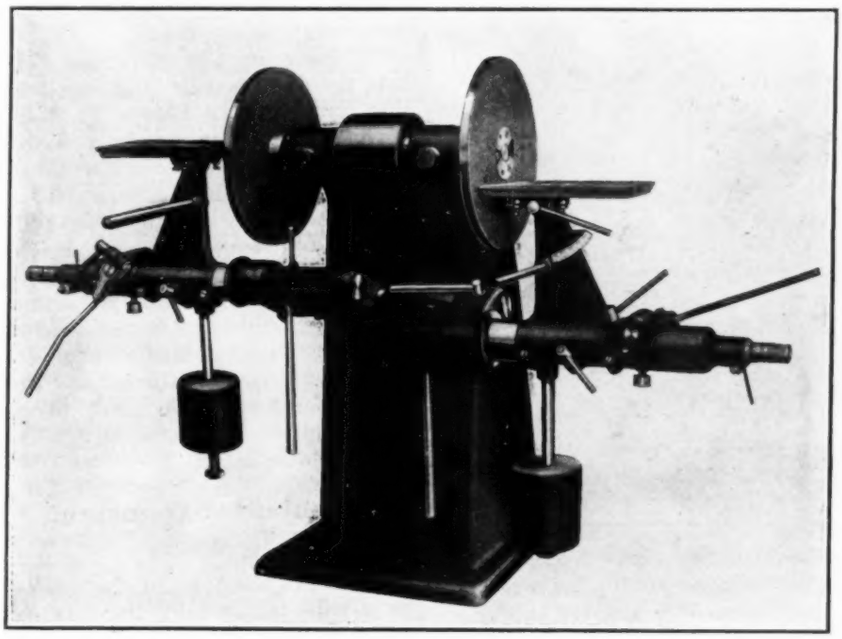
A 45-deg. angular adjustment of the table is available and the table can be quickly secured at the desired angle by means of a clamp handle located directly beneath. None of the adjusting or clamping devices require the use of a wrench, since convenient handles are provided at all points.

The trunnion on which the work bracket is mounted is securely fastened in a U-shaped bracket pivoted in a lug on the frame of the machine. As this bracket is rotated about its pivot the table is raised, or lowered, the action being apparent from the illustration, in which the right-hand table is lowered and the left-hand table is raised. The bracket is moved by means of the handle attached to its under side and can be securely clamped in any position.

For feeding the work toward the wheel, a pinion is mounted on a transverse shaft in the tail of the work bracket and an operating handle can be clamped at any position on the pinion shaft. The pinion meshes with a rack and the rotation of the pinion shaft causes the in-and-out motion of the table. The rack teeth are cut on a bushing which is so mounted on the end of the trunnion that it cannot move longitudinally but rotates about the trunnion center as the work bracket swivels. This arrangement causes the rack and pinion to mesh properly at all times.

At the extreme end of the work bracket a micrometer screw is placed, and serves as a feed stop when it contacts with the end of the trunnion. A handle clamp is also provided for this screw.

The major advantages claimed for this mechanism are the ease and convenience of adjustment to suit any given conditions, and the manner in which all joints and pivots are protected from grit and dust. The trunnion bearings are entirely enclosed and all other wearing surfaces are similarly guarded. Lubrication is accomplished by means of grease cups. The weight of the machine is 1,500 pounds.



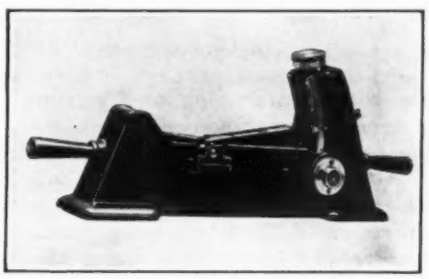
Carpenter Disk Grinder

Societe Genevoise 30-Deg. Precision Machine Level

An accurate machine level with a 30-deg. adjustment range manufactured by the Societe Genevoise d'Instruments de Physique, Geneva, Switzerland, is now being marketed by the R. Y. Ferner Co., 1410 H St., N. W., Washington, D. C. The instrument is intended for use when accurately leveling the beds of machinery, for measuring the desired tilt of work tables for angular work, or for measuring angles on the work itself within the 30-deg. range.

A graduated level vial is pivoted on the heavy cast-iron base of the instrument and is tilted by means of a worm that meshes with an accurate sector. The sector scale is graduated in ½ degrees and a micrometer head on the worm shaft is graduated in 10-second intervals. When the base is horizontal and the bubble of the level is between the graduations on the tube, both the micrometer and the sector indexes will read zero.

When placed on a tilted surface, the angle is measured by rotating the micrometer head until the bubble is again between the graduations on the tube. The level vial is said to be sensitive to six seconds of arc per division, and an accuracy of reading to within 10 seconds is guaranteed by the maker. The instrument weighs approximately 20 pounds.



Societe Genevoise 30-Deg. Precision Machine Level

Barnes Drill Co. Automatic Drilling and Tapping Machines

The Barnes Drill Co., 814 Chestnut St., Rockford, Ill., is now marketing a line of automatic, all-geared, self-oiling, drilling and tapping machines. These machines are built in three sizes, including 20- and 24-in. swing machines and a 22-in. heavy duty size, and all sizes are furnished in the combined drilling and tapping type of construction, or in plain drilling or tapping styles.

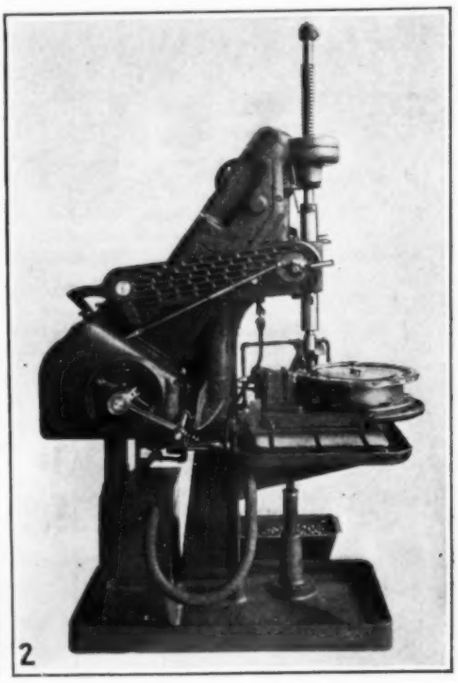


Fig. 1—Barnes Drill Co. No. 205 Automatic Tapping Machine. Fig. 2—Barnes No. 245 Automatic Drilling Machine

These automatic machines embody the usual construction features of the other drilling machines manufactured by this company and have in addition an automatic spindle control. A self-indexing or a hand-indexing work table is also furnished. The No. 205, 20-in. automatic tapping machine is illustrated in Fig. 1, as arranged for automatically tapping and ejecting electrical conduit bushings. The self-indexing work table has 20 positions, and a geared thread leading feed to suit the pitch of the tap used is provided.

The driving and reversing multiple-disk clutches are automatically controlled, so that the tap approaches the work with the proper lead, taps the piece to the predetermined depth, and automatically back out. The self-indexing work table, furnished only with the single-spindle machines, is actuated from the driving shaft of the machine, so that the indexing starts as soon as the tap is clear of the finished piece.

An automatic ejector for the finished work can be furnished, and the work holders are designed to fit the particular work in hand. It is stated that this machine will tap pieces at the rate of 25 per min., the speed depending on the size of the work and the depth of feed required.

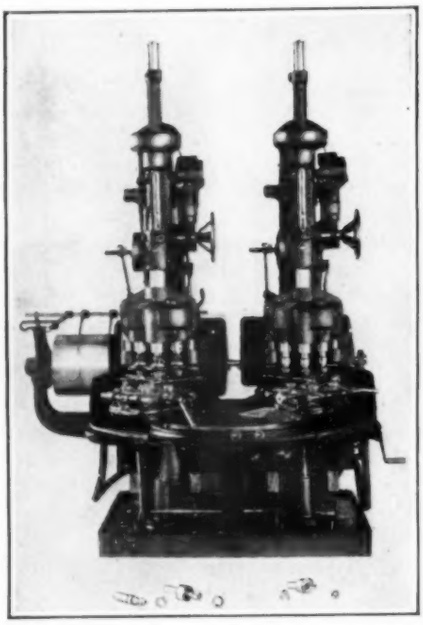


Fig. 3—Barnes Drill Co. No. 222 Automatic Gang Machine

The No. 245 automatic drilling machine is shown in Fig. 2, and is equipped with a 20-position, self-indexing work table provided with self-closing jaws. As the table rotates to the drilling position a roller closes the outer jaw, the work being automatically released after the operation is completed. The table is then indexed to the next position. The automatic spindle control is similar to that for the tapping machine, except for the reversal of the direction of rotation, and the machine can be used for tapping operations when collapsing taps are used.

The gang machine shown in Fig. 3, is the combined drilling and tapping arrangement. This is the 22-in. heavy-duty machine and is designated No. 222. The machine illustrated has a four-spindle auxiliary head attached to each main spindle, and a four-station hand-indexing work table is provided to serve both heads. On two-operation work four pieces are drilled under one head at the same time that four other pieces are being tapped by the other. For single-operation work eight pieces can be tapped simultaneously.

Lambert Expansion Reamers

A recent addition to the line of tools manufactured by the Lambert Tool Co., East 55th St. & Euclid Ave., Cleveland, Ohio, consists of a series of expanding reamers and combination bore-reamers. These tools are intended for use in rapid production work and have exceptional expansion ranges that make them available for a variety of work.

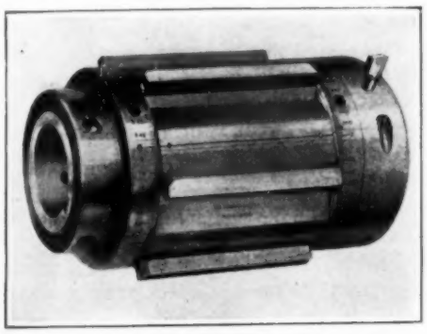


Fig. 1—Lambert Bore-Reamer

A bore-reamer is illustrated in Fig. 1, and can be furnished to fit any size boring bar. The tool shown

is the 5-in. size and expands to 6 in., other diameters and ranges of expansion being furnished to fit practically any bore. Three roughing tools are mounted at the right of the reamer blades. It is said that a 9-in. tool of this type, capable of expansion to 12 in. and mounted on a 3-in. bar, enables the operator to bore and ream

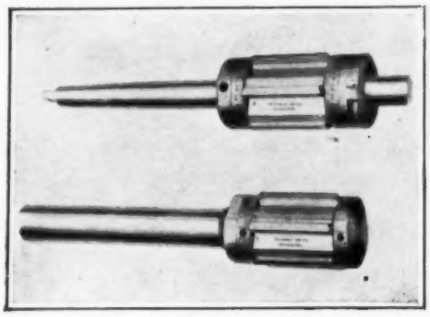


Fig. 2—Lambert Machine and Line Boring Reamers

a 11-in. cylinder, 32 in. long, in one hour. Of this time 40 min. is required for removing the stock and 20 min. for reaming.

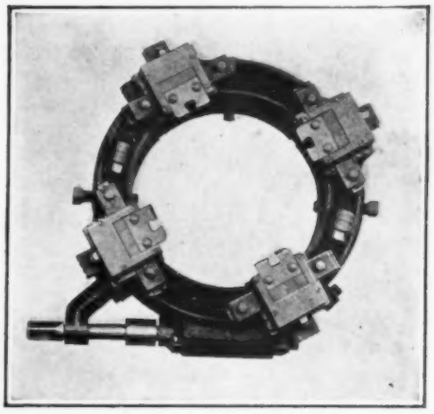
The tool illustrated at the top in Fig. 2 is a machine reamer that can be used on the average machine, the other being a line boring reamer furnished in any size required.

All these tools can be adjusted to within 0.001 in. of the required diameter and each end of the blades can be adjusted independently. This feature makes it possible to give the tools a slight taper at either end if desired. The tool barrel is at all times fixed securely to the body so that a permanent setting is assured.

Beaver Square-End Pipe Cutters

The Borden Co., Warren, Ohio, has recently added three larger sizes to its line of Beaver square-end pipe cutters. These sizes include the No. 6, with a capacity for 2½- to 6-in. pipe and shown in the accompanying illustration; No. 108, 4½ to 8 in.; and No. 112, adapted for use on pipe from 9 to 12 in. in diameter.

The feature of these cutters is the knife construction and automatic feed. The cutters operate like a lathe tool, removing a thin shaving from the pipe at each turn and leaving no burr. They are mounted on a ring that is rotated by means of worm gearing from a driving shaft. The frame of the cutter is placed on the pipe and held in the proper position by setscrews, so that the position of the drive shaft remains fixed.



Beaver No. 106 Square-End Pipe Cutter

The cutter can be operated by a ratchet handle or power can be applied, if desired. The adjustment for different sizes of pipe is easily made and the same cutters are used for all sizes of pipe. The knives are made of vanadium steel and can be resharpened. As shown in the illustration, they are made with a guide which rides on the pipe ahead of the cutting edge, preventing digging-in of the cutter and consequent breakage.

Williams Portable Pipe Threading Machine

The small size portable pipe threading machine, recently placed on the market by the Williams Tool Corp., 12th and Liberty Sts., Erie, Pa., can be used to cut either right- or left-hand threads on from ¼- to 2-in. pipe. Bolts from ⅜ to 1½ in. diameter can also be threaded and, by the use of a flexible shaft, the machine can be used to operate hand stocks for 8-in. pipe.

Williams Portable Pipe Threading Machine

The machine weighs 520 lb. complete. The oil trough and cutting pan under the carriage can be lifted off allowing the carriage and diehead to slide off the ways, and the ways themselves can be removed. The pedestal and headstock remains as a unit and can be handled by two men. It is said that the machine can be knocked down in 2½ min. and reassembled in less than 4 minutes. The ways are made of seamless steel tubing.

The machine is driven by a belt from a motor in the base, and the motor mounting allows the motor to be raised by means of a crank to release the belt and stop the machine. The drive shaft of the machine can be belted to a lineshaft or countershaft instead of the motor, if desired.

The spindle is made of extra heavy seamless steel tubing and has a 2⅞-in. bore. It is mounted in babbitted bearings in the headstock, and sliding gears provide two speeds and a neutral position. A self-oiling system is provided for the headstock.

The front end of the spindle carries a Williams, three-jaw, universal chuck for driving the pipe, a centering chuck for long pieces of pipe being mounted at the rear end and adjusted by a handwheel. The diehead and carriage are cast in one piece and slide on the hardened and ground tubular ways previously mentioned. The front way has rack teeth milled on it, with which the teeth of a pinion mesh. The pinion is operated by a handwheel at the front of the machine for traversing the carriage.

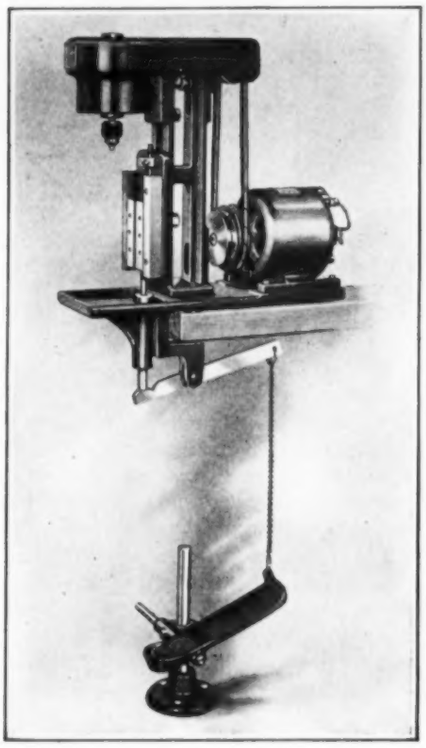
The dies are interchangeable and are operated by a cam and lever. The dies expand sufficiently to allow the passage of pipe with a coupling attached. Four sets of dies covering the range mentioned are furnished.

The cut-off and reaming attachment is fastened to the back of the diehead and is operated by a screw and handwheel. The oil for the cutting dies is furnished by a geared pump driven from the intermediate shaft of the machine.

A high-speed abrasive wheel is mounted on the pulley shaft at the rear of the machine and is driven direct from the motor. This wheel runs at 1,100 r.p.m. and is 6 in. in diameter. The machine is being marketed under the trade name "Willie Williams."

Bicknell-Thomas Vertical Tapping Machine

A high-speed vertical tapping machine with an individual motor drive has recently been added to the line of tapping equipment manufactured by the Bicknell-Thomas Co., Greenfield, Mass. This machine, designated No. 11M, is driven by a ½-hp. motor and has a tapping capac-



Bicknell-Thomas Vertical Tapping Machine

ity of ¼ in. in cast iron or brass, and ⅛ in. in steel. The machine is provided with two tapping speeds, 600 and 1,000 r.p.m. and, for tapping small brass work, speeds of 1,400 and 2,000 r.p.m. can be furnished.

The driving mechanism has a hardened alloy-steel cone clutch mounted on the chuck spindle. This drive is sensitive and, when the tap has entered to the required depth, the spindle automatically reverses at twice the entering speed. The sensitive drive is designed to prevent breaking even the smallest taps.

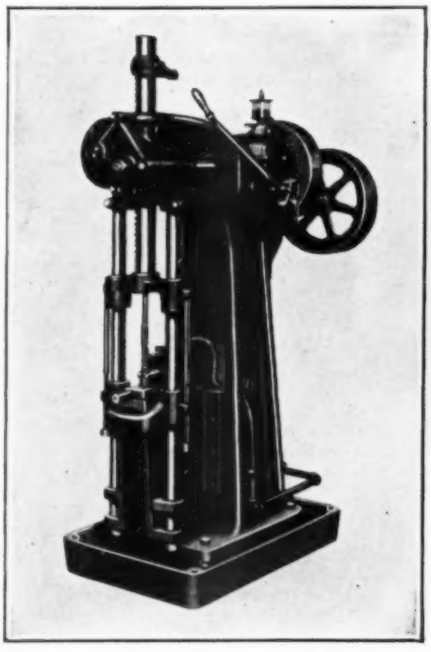
The vertical table slides on steel balls, and has a T-slot and six tapped holes for locating and fastening jigs or special work-holding fixtures. The table is similar to that used on the horizontal tapping machine made by this company, so that the same fixtures may be used on either machine. The table is operated by the lever and foot treadle shown, leaving both of the operator's hands free to handle the work. All moving parts, including the belt, are guarded.

The driving head of the machine is packed with grease, which automatically lubricates all parts. The machine requires an 8x14-in. space on the bench and stands 17 in. above the bench. The weight is approximately 70 pounds. Either d.c. or a.c. motors can be furnished for any required voltage and with cord and attachment plug to fit any light socket. The treadle can be furnished in either of two sizes and is adjustable for height.

Hercules Sub-Press Broaching Fixture

A sub-press broaching fixture, to be used in conjunction with its 15-ton broaching press, is now being marketed by the Hercules Manufacturing Co., 446 East Woodbridge St., Detroit, Mich. The press was described on page 491, Vol. 59, of the *American Machinist*, and is shown in the accompanying illustration with the fixture in place.

By the use of this fixture it is possible to correct a rough-drilled hole by broaching, so that it will be smooth, straight and round. It is stated that this fixture guides the broach so that the hole is square with the finished faces of the boss and



Hercules Sub-Press Broaching Fixture

concentric, and does not allow it to follow the line of an inaccurate hole.

The press shown in the illustration is set up to broach a drilled hole in a steel connecting rod for an automobile engine. The work is held in position on a suitable fixture and the pilot end of the broach is passed through the hole into the guide bushing in the lower guide, so that the broach is guided at both ends as the operation is performed. As the pressure is applied the upper guide, in which the shank of the broach is held, moves downward and pushes the broach through the work. It is said that this finishing operation is performed 20 times as fast as the grinding operation formerly used to correct the hole, and the work is done with uniform accuracy.

After the small hole is broached it is placed over a plug on another fixture and the large end of the rod is finished in the same way. When the broach has passed through the part, the power feed is automatically thrown out and, as the ram returns, the lower guide is lifted back to the loading position by check nuts on the feed rods.

Parker Speed Reduction Pulley

The Parker Machine Works, Riverside, Calif., has recently placed on the market a speed reduction pulley of the planetary gear type. In Fig. 1 a pulley of this design is shown in use on a conveyor installation in an orange packing plant, the compactness of the gear being apparent. All

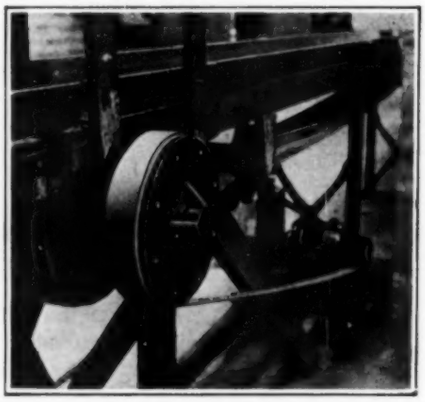


Fig. 1—Parker Speed Reduction Pulley

of the gearing is contained within the pulley itself.

The gear shown in the sectional view, Fig. 2, is designed to give a speed reduction of 625 to 1. The spur gear *A* is mounted loosely on

the shaft and has a long hub which extends into the shaft bearing, where it is keyed securely and held from turning. Meshing with this

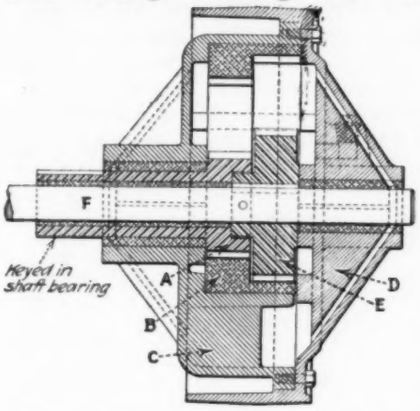


Fig. 2—Sectional view of Parker pulley

stationary gear is the double internal gear *B* which can turn about its own axis when mounted in the casting *C*, as shown.

The spur gear *E* is pinned to the shaft *F* and meshes with the internal gear *B* as shown. The pulley section *D* has a flange for the belt on its periphery and is securely bolted to the internal gear carrier *C*. The rotation of pulley *D* by means of the belt gives the internal gear *B* an eccentric movement about the shaft center and, since it is in mesh with *A*, it must also rotate on its own center. This combined motion causes the rotation of gear *E* and the shaft to which it is fastened, the rate of rotation depending on the ratios of the gears.

For lubrication the gear is filled with oil and any lubricant which leaks along the shaft is carried back into the central space by means of radial oil holes. By attaching a band brake to the end of the hub of the gear *A*, the apparatus may be used as a combined friction clutch and reduction gear, as the shaft will not be rotated if gear *A* is not held stationary.

Landis Hydraulic Traverse Grinding Machine

A high-production grinding machine that embodies some unusual and interesting features has recently been placed on the market by the Landis Tool Co., Waynesboro, Pa. In this machine the wheel head is stationary and the work carriage traverses, the machine shown in the accompanying illustration having a capacity for work 6 in. in diameter and 30 in. long.

A 24-in. grinding wheel is used, this diameter being greater than is generally furnished for work of this size. It is claimed that an increased production rate, as well as a greater

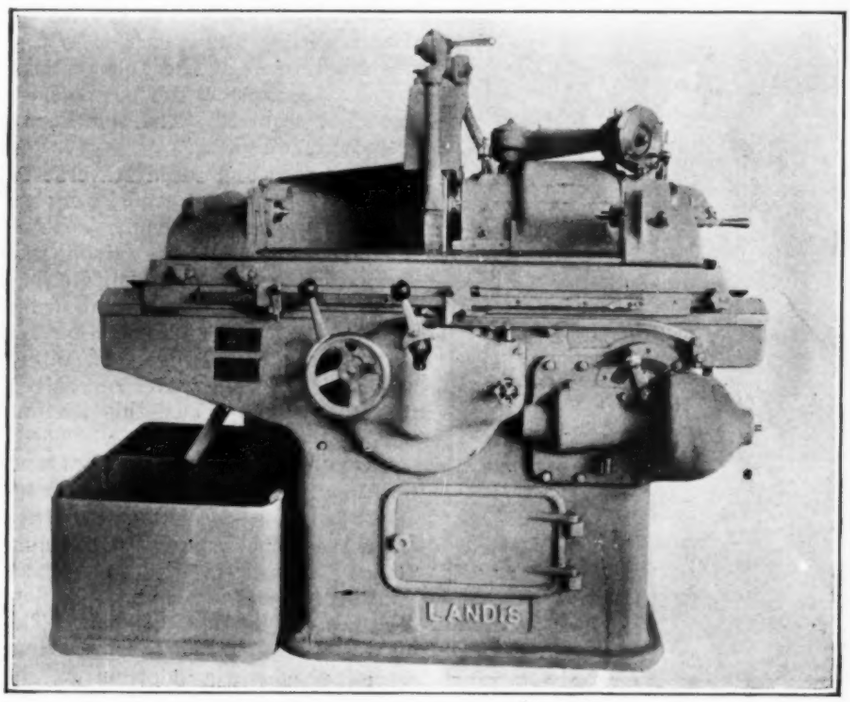


Fig. 1—Landis Hydraulic Traverse Grinding Machine

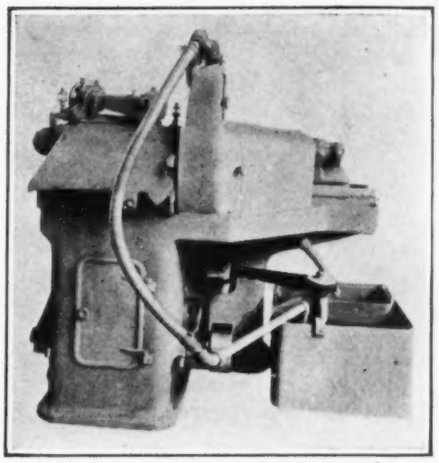


Fig. 2—Rear view of Landis grinding machine

number of pieces ground at one dressing of the wheel, is obtained by the use of the large wheel. The machine is said to have ground as many as 1,200 pieces with a single dressing of the wheel. The weight of the wheel head required to carry this large wheel made it advisable to traverse the lighter work carriage.

The carriage slides on two V-guides that are protected from grit and water and lubricated by means of rollers located in oil reservoirs placed at intervals along the bed. The table is traversed by means of a special hydraulic drive that permits speeds from 6 in. to 40 ft. per min. This speed is controlled by a regulating valve at the front of the machine. The piston of the oil cylinder operates the carriage through a system of levers, so that a comparatively low pressure is used in the cylinder and the possibility of leakage is reduced.

The reversing valve is of the balanced piston type and it is said that reversal of the carriage at the highest speed is accomplished without shock or vibration. The starting and stopping lever at the extreme left of the machine is connected to the control valve, so that the table traverse can be controlled by hand and stopped entirely without stopping the rotation of the work. Oil pressure for the traverse is furnished by a geared pump operated from the drive shaft at the rear of the machine, and the base of the machine serves as a storage reservoir for the oil.

The rotation speeds of the work range from 150 to 800 r.p.m. and are obtained by shifting a single lever at the right-hand end of the machine. This lever operates a shifting key

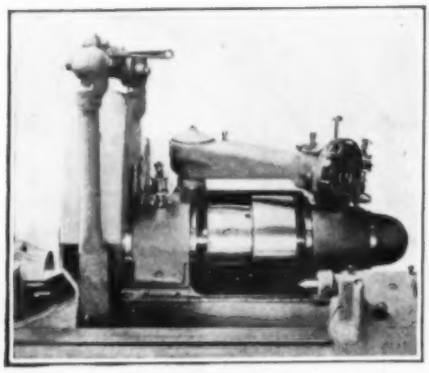


Fig. 3—Landis wheel head with belt guard removed

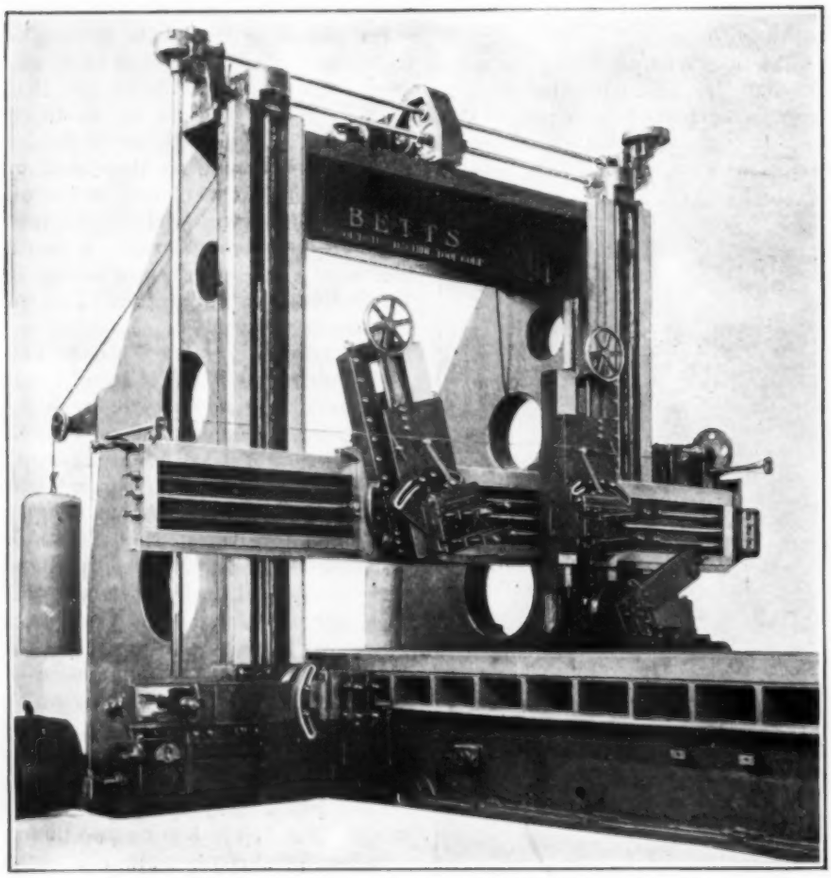
through a series of silent chain sprockets running in oil. The entire speed-changing mechanism is in a single unit and receives its power by a belt from the machine drive shaft.

The wheel spindle is mounted on large bearings in the wheel head and carries a two-step cone pulley, so that the speed can be suited to different sizes of grinding wheels. An automatic tightener keeps the driving belt under uniform tension, regardless of the position of the wheel head. The wheel head is shown in Fig. 3 with the pulley guard removed.

The grinding wheel feed is operated either automatically or by hand, the feeding mechanism being the same as that furnished on former models. The machine can be arranged for either belt or motor drive. For motor drive the motor is directly connected to the rear drive shaft through a flexible coupling.

Betts Large Heavy Duty Planer

An exceptionally large planer has recently been built by the Betts Machine Works of the Consolidated Machine Tool Corp. of America, Wilmington, Del. This machine was designed for such work as planing radial slots in large rotor castings, the slots being 12 in. deep and the weight of the castings approximately 300,000 lb. Forming tools 2 in. wide are used and the rotor casting is supported on trunnions spaced 22 ft. apart. The planer capacity is 120 in. wide by 120 in. high, and the planing length is 30 feet. The machine is adapted for unusually large work, all parts designed for heavy service.



Betts Large Heavy Duty Planer

A large reversing planer motor is used for driving and all driving gears are of steel. The bed is entirely closed across the top except where the rack gear meshes with the table rack. The rack and gear have a wide face and are of coarse pitch.

The table is a double-plate casting, designed so that chips may be raked out without interference. Special grooves are planed in the table to take care of cutting compound and the liquid flows from the table by gravity. The bottom of the table has guides to prevent shifting of the table due to the action of heavy side-head cuts.

The uprights are secured to the bed by tongues and grooves, keys and heavy bolts. The crossrail is carried back between the uprights to provide the necessary stiffness when both heads are planing near the center, and is clamped to the uprights at both the inside and outside flanges.

The crossrail heads are of a special offset pattern that permits working the heads near together. An improved tool-lifting device of simple design is provided, and the tool aprons have T-slots that give a wide range for tool setting.

The side heads are a patented extension slide type, furnished with a knee support for rigidly supporting the tools when the heads are extended a considerable distance from the uprights. This support bears against a finished vertical pad on the inside of each upright and is carried by the side head through the full vertical travel. The support can be removed when not required. The side heads are counterweighted.

Power feed and rapid traverse is provided for all four heads, a motor on top of the machine being used for this purpose and also for raising and lowering the crossrail. The feed and traverse is controlled by a small drum switch, together with push-button stations conveniently located. Only about 4 in. of table travel is required for feeding the heads, this amount being constant for all feeds.

Table tracks, driving gears and bushings are lubricated by a force-feed system, a separate motor driving a large double pump. One pump forces the oil to the lubricating points and the other causes it to flow through an oil filter system. The table tracks have lubricating rollers in oil pockets. in addition to the force-feed system.

American 36-in. Heavy-Pattern Lathe

An improved model heavy lathe is now being marketed by the American Tool Works Co., Cincinnati, Ohio, and has been designated the 36-in., "super-productive," heavy-pattern lathe. The machine swings 40¼ in. over the bed and provides a distance between centers, with a 12-ft. bed and tailstock flush, of 4½ ft. The 12-ft. bed is the minimum length and longer beds can be furnished, the lengths increasing in 2-ft. increments. The swing over the carriage is 27½ inches.

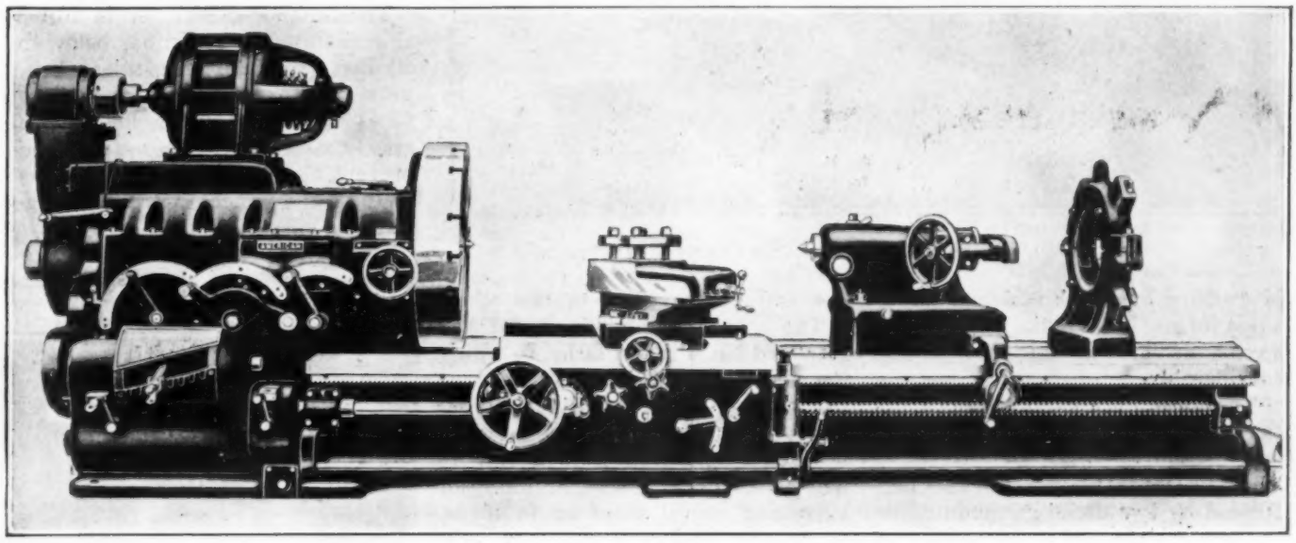


Fig. 1—American 36—In. Heavy-Pattern Lathe

A feature of this lathe is the 18-speed, all-geared head, shown with the cover lifted in Fig. 2. This head is of the selective speed type, is provided with both faceplate and spindle drives, and can be either belt- or motor-driven. For motor driving, a motor with a capacity of from 25 to 40 hp. is needed, depending on the nature of the work. The motor is mounted on the headstock, as shown in Fig. 1, and drives the first shaft through herringbone gears that are entirely enclosed and run in oil.

The faceplate drive provides 12 of the 18 speeds, only 6 speeds being transmitted through the spindle. Consequently, all severe turning operations are performed while driving through the faceplate internal gear and its pinion. The highest speed of the faceplate drive is 32½ r.p.m., thus giving a reasonable cutting speed on comparatively small diameters.

All of the 18 speeds are obtained by the use of 16 gears, including the faceplate gear and pinion. No clutches are used and the only gears in operation at any time are the ones that are transmitting power. The head can be simplified for use with a variable-speed motor, six mechanical speeds being provided. The gears are of high-carbon, chrome-manganese steel, heat-treated and hardened. The spindle and all other shafts are mounted in bronze bushings and an automatic oiling system is provided for all gears and shafts in the head.

The starting clutch and brake are incorporated in a detachable unit located in the driving pulley of the belt-driven machine or in the large motor gear of the lathe with a motor drive. The unit is enclosed and operates in oil. A mechanical apron control for the clutch and brake is furnished and is operated by a lever at the right-hand side of the apron. For a lathe driven by a variable-speed motor, an electrical apron control can be furnished.

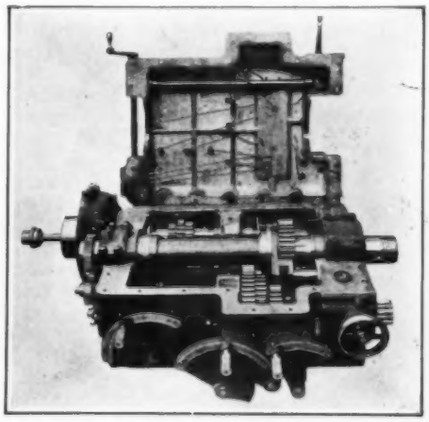


Fig. 2—American 18-speed geared head

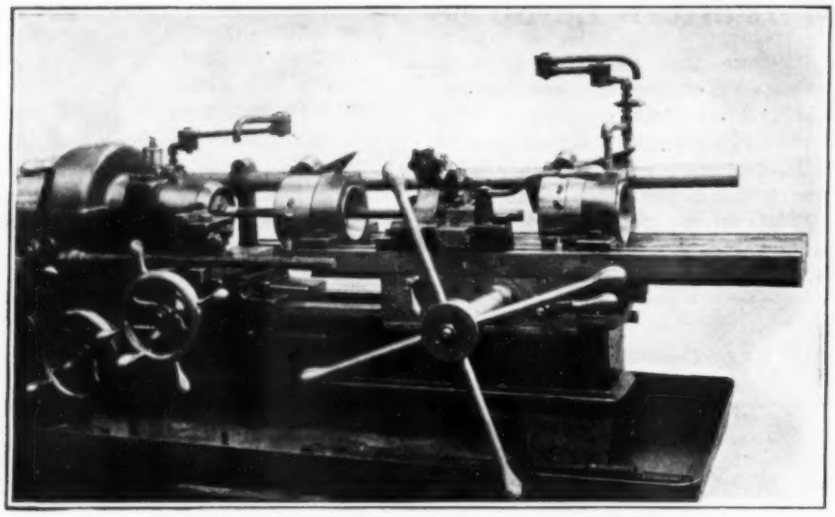
The bed has been widened and strengthened and the design of the tailstock has been improved. The handwheel for adjusting the tailstock spindle is located near the left end of the tailstock, and is connected to the spindle through an angular shaft and bevel gears.

Other usual features of lathes manufactured by this company are provided. The quick-change gear mechanism provides 48 changes of thread and feed, and additional threads can be cut by the application of additional gears on an auxiliary quadrant at the end of the bed. The hole through the spindle is 2⅛ in. in diameter and the centers have a No. 6 Morse taper. The leadscrew is guaranteed accurate within 0.001 in. per ft. and is 2½ in. in diameter with 1 thread per inch.

The net weight of the machine with a 12-ft. bed is 23,050 pounds.

Warner & Swasey Improved Staybolt Machine

In improving its staybolt machine, the Warner & Swasey Co., Cleveland, Ohio, has recently added forming, facing and turning attachments to the former model, which was described on page 388, Vol. 56, of the *American Machinist*. As now equipped, the machine will turn and face the end of the staybolt before the threading operation, thereby relieving the chasers of the necessity



Warner & Swasey Improved Staybolt Machine

of working on rough scale. This insures longer life for the chasers and speeds up the threading operation considerably.

The forming tool is mounted in the cross-slide and prepares the head end of the staybolt for threading. The threading operations are performed by two dieheads mounted on the turret slide, and so adjusted that the thread lead is continuous from one end of the piece to the other.

The machine is made up of the standard No. 4 turret lathe, to which the necessary attachments for staybolt making are secured. The lathe may be used for other purposes when not required on staybolt work. It will handle crown stays, button-head stays and swivel stays up to 40 in. in length, and will cut any size thread.

Cleveland Combination Punch, Shear and Forming Press

A combination multiple punch, gate shear, and gap forming press has recently been placed on the market by the Cleveland Punch & Shear Works Co., Cleveland, Ohio. The machine illustrated in Fig. 1 is arranged as a multiple punch.

The distance between the vertical housings is 12 ft. 2 in., and the height of the horizontal gap is 15 in. The bracket for the driving motor is located behind the gearing at the right-hand end of the machine, and a positive jaw clutch is installed in the drive. For forming work a friction clutch is provided. The slide is adjustable and safety counterweights are provided. All the gears are of steel with cut teeth.

The automatic stripper is adjustably mounted on trunnions below the sliding head, the adjustment being provided so that the flat finished faces of the stripper fingers will always strike the stock squarely, and prevent the binding of the punched plate on the punches. This arrangement is said to reduce breakage of the punches greatly. The stripper fingers are of cast steel and may be readily adjusted or removed from the machine.

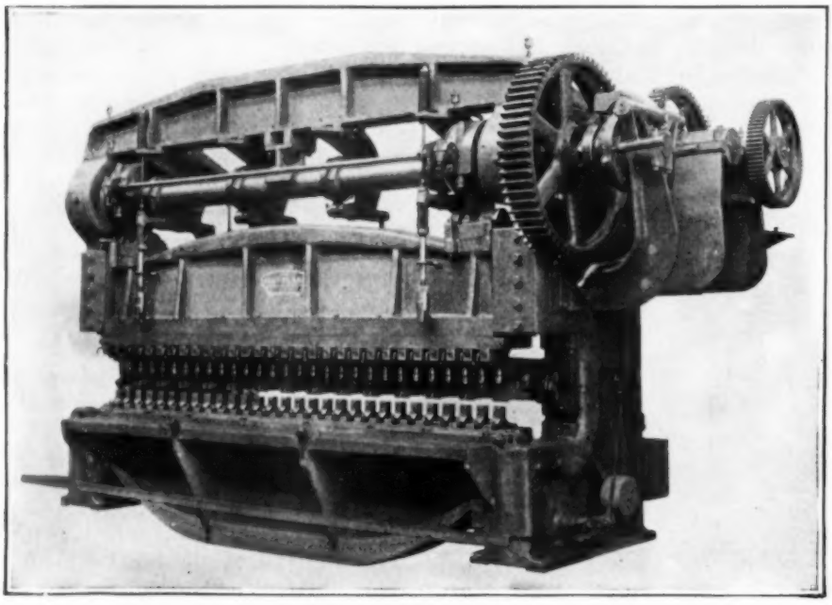


Fig. 1—Cleveland Combination Punch, Shear and Forming Press

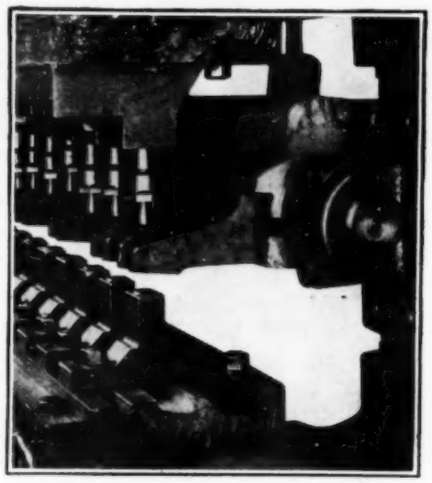


Fig. 2—Cleveland one-bolt attachment for punches and dies

In Fig. 2 the method of attaching the punches and dies is illustrated. Each punch or die requires but one bolt to hold it securely in place, the tails of the holders fitting into a slot. This arrangement is said to have advantages over the usual T-shaped attachment with bolts front and rear, since it was almost impossible to get at the rear bolt without removing the stripper, and two men were required to set up the machine. With the single-bolt design one man can set up the machine without trouble.

A plate shearing attachment is interchangeable with the punching apparatus and can be quickly installed on the machine when required. A pedal for operating the clutch is conveniently located at the front of the machine.

News of the Week

Paul C. De Wolf Is Elected President of Metal Trades Association

Successful sessions held at twenty-sixth annual convention

Many subjects of interest to manufacturers engaged in the metal trades were brought up and discussed at the twenty-sixth annual convention of the National Metal Trades Association that was held at the Hotel Astor, New York City, April 23 and 24. With W. W. Coleman of the Bucyrus Co., So. Milwaukee, Wis., and president of the association, in the chair the program and business sessions were successfully and satisfactorily conducted, and those attending expressed the opinion that this meeting was the most instructive and important in the entire existance of the organization.

Paul C. De Wolf of the Brown & Sharpe Manufacturing Co., Providence, R. I., was elected president to succeed Mr. Coleman. Mr. De Wolf has been the second vice-president during the past year. The other officers elected were: Paul T. Norton, the Case Crane & Engineering Co., Columbus, Ohio, first vice-president; Harold C. Smith, the Illinois Tool Works, Chicago, Ill., second vice-president; J. W. O'Leary, the Arthur J. O'Leary & Sons Co., Chicago, Ill., treasurer. L. W. Fischer remains as secretary. Councilors elected for a period of two years were: Horace P. Dix, the Wilmarth & Morman Co., Grand Rapids, Mich.; C. W. Russell, the Russell Wheel & Foundry Co., Detroit, Mich.; Frederick Fosdick, the Fitchburg Steam Engine Co., Fitchburg, Mass.; C. B. Hayes, the Hayes Wheel Co., Jackson, Mich.; C. R. Gardinor, the International Silver Co., Meriden, Conn.; and W. D. Oakes, the Oakes Co., Indianapolis, Ind. Councilors elected to fill unexpired terms were: W. W. Coleman, the Bucyrus Co., So. Milwaukee, Wis., and E. J. Miller, the St. Louis Screw Co., St. Louis, Mo. The honorary councilor re-elected is Justus H. Schwacke, William Sellers & Co., Inc., Philadelphia, Pa.

Resolutions Adopted

The resolutions committee reported several resolutions and they were unanimously passed by the members. One called for an appropriation of $10,000 for industrial education, another for a $5,000 contribution to the National Industrial Conferende Board, another called for an appropriation of $5,000 for use in publicity.

A resolution was also passed asking that a department be established for assisting members in problems that arise in industrial relations. It was suggested that the president appoint a committee and that sufficient funds be appropriated for this work.

Due to the absence of the newly elected president, Mr. De Wolf, who recently met with an automobile accident, Mr. Norton, first vice-president-elect, took the chair and assumed the duties of the presiding officer.

In the report of the retiring president, it is stated: "It is true that in the beginning our organization was one for defensive purposes only, but as it grew it prospered. It is now an organization for strongly constructive purposes, always keeping abreast of the times and often ahead of them in those things which better conditions in industry and improve the human relations therein."

Mr. Coleman further emphasized the fact that the open shop, accident prevention, industrial education, proper wages for employees, the introduction of the physician in industry, and industrial relations were all subjects fostered by the association.

Secretary Fischer reported on the various branches of the association and the work that had been done during the past year. Safety engineering, industrial training, the research and statistical department, and other subjects were dwelt upon.

The program presented included the following topics and speakers: "Industrial Training from a Practical Viewpoint," John C. Spence, the Norton, Co., Worcester, Mass., with discussions by Thomas Shipley of the York Manufacturing Co., York, Pa. and George P. Aborn, the Worthington Pump & Machinery Corp., East Cambridge, Mass.; "The Farmer of Tomorrow," L. J. Taber, master of the National Grange; "Present Day Conditions in Russia," Count Ilya Tolstoy; "The American Spirit in Industry," Rev. Marion D. Shutter, Church of the Redeemer, Minneapolis, Minnesota; "The Physician in Industry," Dr. John J. Moorhead, Professor of Surgery, New York Post Graduate Medical School and Hospital, New York City; "What a Medical Department in Industry Actually Does." Dr. W. I. Clark, the Norton Co., Worcester, Mass.; and "Medical Service a Vital Factor in Industrial Relations," Dr. O. P. Geier, the Cincinnati Milling Machine Co., Cincinnati, Ohio.

Canada Cuts Tariff on Machinery

Manufacturers in United States now able to compete

Important reductions in the tariff duty on production tools and machinery, in connection with practically every basic industry, such as agriculture, mining, lumbering, dairying and fishing have just been announced in the Canadian budget. In an effort to protect the Canadian manufacturer there has been a lowering of the sales tax on such equipment, and provision has been made for the free entry of the raw materials necessary for the manufacture of all products to which the tariff cut applies.

Mining men and farmers of the Dominion seem satisfied with the changes, but manufacturers of agricultural implements view the tariff cuts with alarm, declaring the reductions ruinous to them and beneficial to the implement manufacturers of the United States.

Insofar as agricultural machinery is concerned, the changes in the general tariff include a reduction from 10 to 6 per cent on mowing machines, harvesters, binders and reapers; from 12½ to 7½ per cent on cultivators, harrows, horse rakes, seed drills, manure spreaders and weeders; from 15 to 10 per cent on plows, threshing machines and complete parts thereof; and from 15 to 10 per cent on such field implements as rollers, post hole diggers, etc.

The fruit growing industry is effected by a reduction from 15 to 10 per cent on spraying machines, fruit or vegetable grading machines, pruning hooks and pruning shears. In the poultry industry, the cut is from 15 to 10 per cent on incubators and brooders. Dairying machinery is affected by a reduction from 15 to 10 per cent on milking machines, centrifugal machines for testing butter fat, milk and other dairy products.

Heavy Machinery

Machinery used in mining and quarrying is reduced from 27½ to 20 per cent, the cut including, rock drills, percussion coal cutters, coal augers, stamp drills, ore and rock crushers and rotary and coal drills. The reductions in coal machinery are from 30 to 12½ per cent on coal-washing machinery, and apparatus for use exclusively in the distillation or recovery of products from coal tar or gas. And finally the reductions on lumbering machinery include from 25 to 20 per cent on sawmill machinery; from 30 to 20 per cent on logging machinery including, logging cars, blocks and tackle, yarders and practically all machinery used exclusively for logging operations, and from 25 to 10 per cent on logging wagons.

Hold Annual Meeting of Welders

The annual meeting of the American Welding Society was held in New York City, April 23-25. Over 100 members attended the various events which included a dinner, a smoker, an inspection trip and the technical session.

A new feature this year was the smoker arranged and presided over by C. J. Holslag of the Electric Arc Cutting & Welding Co. The feature of the evening was a short address by Joseph W. Meadowcroft, superintendent of welding at the Philadelphia works of the Edward G. Budd Manufacturing Co. Mr. Meadowcroft told of some of the unusual welding problems connected with the manufacture of all-steel automobile bodies and then explained the operations shown in three reels of motion pictures taken in the Budd plant. The other speaker was A. M. Candy of the Westinghouse Electric & Manufacturing Co., who read a burlesque history of arc welding. Smokes were provided and also a punch made up, as described by Mr. Holslag, of equal parts of acetylene welding rods and electrodes, reinforced by "the stuff they use to set off the thermit reaction."

The inspection trip to the Brooklyn Navy Yard was under the direction of F. E. Rogers of the Air Reduction Sales Co. A large crowd turned out to see the welding work in progress in the Navy Yard shops and the cutting up of two of the unfinished battleships condemned under the terms of the Disarmament Conference.

The technical session consisted of a symposium on the subject, "Flexibility versus Rigidity in the Design of Welds." The speakers were J. C. Lincoln, S. W. Miller, C. J. Holslag, H. A. Woofter and J. H. Deppeler. It had been hoped that A. G. Pack, chief inspector, Interstate Commerce Commission, would talk on railroad shop welding, but he was unable to come and C. W. Roberts, of the Pennsylvania Lines West, showed some slides of typical railroad shop welds and discussed the problems involved.

At the business meeting the usual reports were read and the following officers for the ensuing year were elected: President, E. H. Ewertz, the Bethlehem Shipbuilding Corp.; vice-presidents, T. A. Wry for New York and New England, J. D. Conway for the Middle Eastern district and H. S. Mann for the Middle Western district. Directors-at-large elected were J. H. Deppeler, A. S. Kinsey, W. A. Slack and E. M. T. Ryder.

Diesel Engine Order for Worthington

The Worthington Pump & Machinery Corp. has been awarded a substantial part of the Diesel engine and pumping equipment for the new McCorckle Pipe Line Co. project in Texas. While details have not been concluded the award will approximate $500,000.

The Worthington Pump & Machinery Corp. closed its power and mining machinery works at Cudahy, Wis., on April 30, in pursuance of its policy of concentrating manufacturing facilities in its larger works.

All lines of products were transferred to its other works, except the mining, crushing, cement and creosoting machinery. Manufacture of these products will be discontinued permanently since they have little in common with the other products. Arrangement has been made with the Allis-Chalmers Co., however, to take over all records, patterns and stock on hand of these products so as to supply repair parts and equipment similar to that which Worthington has been making.

Aim to Standardize Tee-Slots

The first meeting of sub-committee No. 1 of the Committee on Standardization of Small Tools and Machine Tool Elements was held in New York on April 24, in the rooms of the A.S.M.E., with J. B. Armitage of the Kearney & Trecker Corp. H. Casler of the Marvin & Casler Co., H. Buker of the Brown & Sharpe Manufacturing Co., H. Cadwallader of the Standard Shop Equipment Co., S. Jay Teller of the Pratt & Whitney Co., Harry E. Harris, of the Harris Engineering Co., Messrs. Agnew and Schlink of the A.E.S.C., and F. D. Jones of *Machinery* and Fred H. Colvin of *American Machinist*.

S. J. Teller was elected temporary chairman and H. Casler temporary secretary of the meeting, but both will probably be continued as permanent officers. It is the aim of this committee to study present practice in the matter of Tee-slots, and to determine on a set of standards which will best serve the industries affected without disturbing present conditions more than necessary. A large amount of data has already been collected which will be carefully studied by a sub-committee of three before being presented.

The committee on proposing Tee-slot standards must of necessity consider bolts and nuts used in holding work or fixtures, chip clearance and strength of metal above the slots. The work is sponsored by both the National Machine Tool Builders' Association and the A.S.M.E.

Notes on Washington Activities

By Paul Wooton

Power by which the President would have authority to mobilize the economic resources of the country in the event of war was advocated before the House military affairs committee recently by Secretaries Hoover and Wilbur. They differed, however, as to the means of bestowing such power.

Testifying briefly, Secretary Hoover declared that the President should have practically unlimited authority in times of war, and that the time to confer such authority and arrange the machinery for its execution is in a period of peace. Industry should be subjected to penalties for moral infractions, he said, just as a soldier is subject to discipline for infractions of military regulations. Mr. Hoover expressed the opinion that such authority could be conferred through legislation by Congress.

Secretary Wilbur asserted the opinion that the end sought could be accomplished only through adoption of a constitutional amendment. Conscription of the civilian population under existing organic law would be unconstitutional, the new Secretary of the Navy stated, and he said grave doubt existed whether war-time price-fixing or limitation of profits would be legal without amending the constitution. While expressing sympathy with the principle underlying the bills on which the committee is conducting hearings, Secretary Wilbur warned that the subject should be approached only with the utmost consideration. To go too far toward a military dictatorship might destroy the government itself, he said.

Following a brief hearing, the ways and means committee has authorized Representative Green, chairman, to introduce a bill directing the Treasury Department to remit customs duties which it charged against the War Department for military supplies and equipment which were returned from foreign soil after the armistice.

The Treasury, having no alternative under the tariff law, charged a duty on all returned supplies which had been changed in character after having been sent abroad.

Testifying before the committee, Major E. P. Pierson, of the office of the Assistant Secretary of War, the only witness, pointed out that even though some of these returned supplies had been sold as surplus subsequently, no duty should be charged against the War Department, as the government would gain nothing, merely transferring money from one pocket to another.

Industrial Museum Is Advocated

A nation-wide movement is under way to provide vocational guidance for boys by means of industrial museums conducted under the auspices of the National Museum of Engineering and Industry.

The appointment of an organizing committee of 100 to foster the museum project has just been completed. It includes foremost engineers, financiers, educators and other men of national prominence. Irving T. Bush, Cleveland H. Dodge, Otto H. Kahn, Julius Rosenwald, Mortimer L. Schiff, Samuel M. Vauclain, Thomas W. Lamont, General T. Coleman du Pont and Colonel Michael Friedsam are among those interested in the movement. F. A. Delano, regent of the Smithsonian Institution, is chairman of the committee. George E. Roberts, vice-president of the National City Bank, is treasurer. H. F. J. Porter, a mechanical engineer and one of the early sponsors of the museum idea, is secretary.

England's Unemployed and Labor Disputes

Inequality of wages—Exporting increasing—Many American visitors—Machine tool production steady—Britain's finances better

By Our London Correspondent

WITH more to follow, England is still working through a series of strikes and similar labor disturbances that have come to a head since the formation of the labor government. It is, however, unfair to connect the two, for these troubles, or the more important of them, have been brewing for a considerable time, and it is clear that sympathizers with the government would not wilfully present them with labor problems that have thus arisen at the outset of their career. It is true that the government undertook to deal with unemployment, but this is not necessarily the same as acting as go-between, and even provider of special parliamentary bills, for the disputants. Of late some of the disputes have been fought at the direct expense and the direct suffering of the ordinary public. In fact most of these disputes eventually take the form of a triangular duel in which the public form the third party, unprotected and unarmed, and while the other two duelists attack each other they unite in assault on the third member of the triangle. This was obviously true of the London transport dispute, a strike remarkable for the readiness which other workers in the same industry but not directly concerned, took part or were ready to take part.

England and Exporting

The result emphasizes again the disparity between the economic conditions of workers who are in sheltered or protected industries and of those who have to meet the full force of competition from abroad and who are consequently unable to sell their products at anything higher than world prices, particularly if they wish to undertake export trading. And, as it is perhaps somewhat tiring to repeat, Great Britain cannot support her present population unless a large and, in fact, a growing export trade is done. Another obvious anomaly will be found on comparison of the wages paid to skilled men in the trades concerned with export and unskilled men in other industries.

Municipally-employed dust-men have long been much better paid than engineering workmen and, in fact, other skilled people. Yet not very long ago the engineering workman was known as the aristocrat of labor. How deep it is possible to dip into the pocket of the rate payer and the tax payer, rather than the skill employed, is now the measure of the wages that will be received for any given work. In the London tramway dispute the settlement was based on terms which can only render the system insolvent. But the workers concerned have the rates on which to draw. Meanwhile these rates have to be provided, at least in part, by people who are unsheltered in the economic sense and who are thus doubly handicapped in their struggle for a share in the world's trading.

Although the current year has shown an improvement, unemployment is, of course, still with us, and so far since the Armistice in various ways it has cost the country about 560 million pounds, not of course all on unemployment but partly in re-settlement, training and similar schemes.

End of Surplus War Goods

In view of the fact that it has had to effect the sales of surplus war assets, including machine tools and many other engineering products, besides large stacks of raw materials, the end of the Disposal and Liquidation Commission may be recorded. Succeeding the Ministry of Munitions, its sales have realized during the past five years some 665 million pounds, involving, it is stated, about 3,000,000 separate business transactions. Machinery is included with rolling stock and industrial plant sold to the value of 24 million pounds, and metals were sold to the value of 70 million pounds. The same body has the duty of liquidating the liabilities arising from the cancellation of war contracts, estimated at 355 million pounds. According to report, the total amount of material and stores handled reached 5,000,000 tons. The commission is succeeded by the Surplus Stores, etc., Liquidation Department of the Treasury.

Something of an improvement can be recorded in connection with shipbuilding, particularly on the Clyde, where for the first quarter of the year the output amounted to 105,742 tons as compared with 68,441 tons in the corresponding period of last year. The output for March, in fact, namely, 58,218 tons gross, was the largest launched on the Clyde for the month of March since 1911. Oil-engined vessels made marked progress, and the receipt of further orders is reported.

Industry's Future

No real change is discernible in the condition of the engineering industry as a whole, but it has hanging over it a cloud in the form of a demand for an increase in wages, the exact amount of the increase not yet having been stated. It will be a national demand, local applications having already been refused. The machine tool industry remains but moderately employed, a large proportion of such orders as have been placed of late being from automobile firms. Here, more particularly as regards lighter cars, an advance can be reported and, although it is not general, there has been an actual shortage of some chassis of the higher class. The value of the motor cycles and parts shipped abroad has very definitely increased as compared with last year, and exports of ordinary cycles have also advanced. England does a large trade in the export of parts, Japan being a specially good customer. Cycle imports are negligible, even as applied to components.

As many Americans visit the Science Museum at South Kensington, S. W., it may be well to record the inauguration of a series of daily lecture tours. The lecturer is fully qualified from the technical point of view, and in due course the whole range of engineering, as shown at the museum, is being dealt with. The museum is of course in process of extension, and the exhibits are being re-arranged.

To conclude in brighter tone, the latest official figures give the number of persons registered as unemployed in Great Britain as about 1⅛ million, the decline during the present year approaching a quarter of a million. The Budget figures for the fiscal year just ended are better than the biggest optimist hoped, as, while the original estimates suggested an almost negligible surplus, the actual excess of receipts over expenditure is about 48½ million pounds, which, together with 40 million specially allocated from the total, goes automatically to the reduction of the national debt thereby improving general conditions.

Interesting Figures on British Commercial Aircraft

Last year British commercial aircraft flew rather less than a million miles, the figure reported being 943,000, and, although there was a falling away in the number of passengers on the London to Paris route, a total increase for all routes was shown. British planes carrying nearly 12,000 passengers, and foreign machines more than 3,000 passengers. Goods carried by British machines amounted to more than 300 tons, while foreign machines brought very nearly 500 tons, and, looking at both passengers and goods carried per plane, the increase is about 50 per cent on the year. To obtain a subsidy it is necessary to complete a flight in a specified time; this was done in more than 90 per cent of the flights. Fog is of course a handicap in this country, and spoilt some of the experiments made last autumn to expedite the carriage of American mail to Manchester and also to Belfast. For the former nearly three-quarters of the scheduled flights were completed, but in the case of Belfast the proportion was more than half. Owing to the weather conditions the mails were not always accelerated, but on an average where there was acceleration the gain was 13¾ hours to Manchester and 20 hours to Belfast.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance*, New York

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PESSIMISM is plausible and probably popular at present, but the facts do not warrant the gloomy predictions that are to be heard.

A period of abnormal expansion in business always precedes an era of contraction and not having had the first we cannot have the second. There is, however, an utter absence of marginal speculation for the rise and the dullness of the exchanges has created an illusion of depression among the brokers who profit when the public are trading actively. But an illusion is just as serviceable as a reality to the professional bears, and they have taken advantage of a purely psychological condition to literally knock the stuffing out of some over-exploited stocks, such as Yellow Cab and Congoleum.

The result is that the lambs who have been shorn of their precociously grown fleeces are bleating loudly. Well seasoned investment stocks have meantime been moving upward and nearly all the government bonds outstanding have touched par or better. It is also significant that brokers' loans have been much reduced and that the existence of a large short interest in the stock market is to be inferred from the fact that more than fifty of the speculatively favorite stocks were "loaning flat" last Wednesday. In the financial markets technical conditions are therefore in favor of a rise and while it may be difficult to make stock exchange speculation fashionable again it is at least clear that the liquidation has been thorough and complete.

Judge Gary's remarks at the stockholders' meeting of the Steel Corporation were pessimistically construed by a public that was in a pessimistic mood, but the Judge himself disclaims this construction; and as far as an outsider can discover the demand for steel is up to the average, though somewhat below the peak. The distributive trade of the country as indicated by retail sales is fully up to normal, but every one is sticking close to shore and hand to mouth buying continues to be the rule.

There are, however, a few dark spots. One is coal. The demand is undoubtedly poor. This is due in part to the mild winter and in part to the increased supply of white power that is being constantly made available as the new hydro-electric plants recently under construction are completed.

Another dark spot is the leather and shoe business. Some curious explanations for its depressed condition are offered. It is alleged that shoes last longer than formerly because walking has become a lost art now that every one rides in automobiles and that there is no demand for harness leather because the motor has superseded the horse.

But the automobile industry upon which so many things are blamed is not itself in an entirely satisfactory condition, for there seems to be no doubt that the manufacturers have overcalculated this year's demand. The situation is not, however, as serious as many assume, for thirteen companies make 95 per cent of all the automobiles sold and they are strong enough to go through more than one year of dull business without acute distress. Of the remaining 5 per cent of the production one-half, or 2½ per cent, is manufactured by 13 other companies, and the last 2½ per cent is the product of 78 additional companies.

In these last two groups there are some concerns that may have to face absorption or liquidation unless there is a marvelous revival in the demand for cars, but viewing the situation at its worst it does not appear to be serious and would not be so regarded were it not for the effect that the decline in some motor securities has had upon the public imagination.

One other dark spot that some consider ominous is the over building that has taken place in our larger cities. In New York and some other places it has been stimulated by laws which exempt newly constructed apartments and other residential buildings from taxation and throughout the country it has been facilitated by the ease with which bonds on structures that were well advertised could be sold to the public. The high cost of building and financing this new construction presupposes rentals that are equally high and if there should be a real depression in business it is quite possible that it would be reflected by an acute depression in the price of city realty. But here again we are looking rather far ahead, for as real estate is generally the last thing to advance in times of prosperity so it is the last thing to decline when the tide turns.

In this rather comprehensive survey of our domestic conditions the features that are so generally regarded as disturbing have been brought into relief that they may be intelligently weighed.

Against them is to be put the satisfactory condition of our railways, the abundance of bank credit, the improvement abroad, the advance in foreign exchange and the probability of a consequent increase in our export trade as soon as the crops now being planted are ready for market.

So compared, the favorable seem to greatly outweigh the unfavorable factors, and although the scales are never stationary their present reading appears to spell stability and prosperity.

What's Doing in Industry

The machinery and machine tool business during April was somewhat better than that of March, but this fact is not as cheerful as it would seem on the face of it, as the average was brought up by a few big orders rather than by steady improvement. Dealers are still hopeful and some predictions are being made that definite improvement will be seen after the conventions of the political parties have concluded.

Steel production is down from its record, but is still very gratifying and no serious let-up is anticipated in this line.

Intensive sales campaigns staged by the automobile builders proved to be fairly successful and it is expected that production schedules will be improved slightly. Figures predicted at the first of the year, however, will not be attempted, and if the industry finishes as strongly as it did in 1923 it will be considered satisfactory.

Speculative stocks, U. S. Steel and some of the automotive issues felt a downward pressure during the past week, but a partial recovery in a dull market followed.

General retail business remains good and none of the major industries report either over-production or an over-stocking of warehouses, thereby discounting pessimistic talk of depressions, either large or small.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Buffalo

There has been no change for the better in the Buffalo machine tool market in the last ten days or two weeks and in some cases even less business has been done than in the same period previous. In the opinion of most of the dealers the sale of used equipment is cutting into the new machinery market.

Some sales of 5-ft. and 6-ft. radial drills are reported, but there is little else of any consequence. Comparatively a large number of smaller tools are moving, but the volume of this business is not enough to keep the dealers and manufacturers happy. The tendency among buyers to shop around is becoming more pronounced, which means that the salesmen today are spending more time and effort to get a smaller volume of business.

Inquiries have fallen off slightly since the first of the month, and few lists that were out at that time have actually been filled as yet.

Cincinnati

Business in the machine tool industry of Cincinnati is quiet at the present time with indications pointing to a continuation of this condition during the next few weeks. Although there are lists out for a considerable amount of machine tools, executives responsible for purchases are showing caution in actually placing orders. The volume of business that has been coming into local plants from the automobile manufacturers has been cut down within the last month. Detroit automobile concerns are still placing some business with Cincinnati machine tool companies, but it is limited in quantity due to the reduced production schedule in many automobile factories. The railroads have delayed their purchases and it looks now as though they will not be in the market actively until May or June. Several prominent machine tool executives believe that the railroads will run along with used equipment during the early summer and will not buy many machine tools until the latter part of the summer.

The volume of production of Cincinnati plants in the first four months of this year has fallen below the production for the corresponding period in 1923. The past month has witnessed a material reduction in the amount of business that has been placed locally.

Sales of lathes have been lagging lately and it has been necessary to decrease production schedules. Inquiries have been fair, but operations are expected to continue at about the present scale for several weeks at least. Planers have been in fair demand while there has been a slump in the sales of upright and radial drills. Electrical tool manufacturers report that their operations have been fairly satisfactory in the past few weeks. Conveying machinery manufacturers continue to produce at capacity, while woodworking machinery companies are likewise turning out a large volume of business. The used machinery market has been in fair condition with purchasers showing an inclination to buy the cheaper grade of machinery.

The sales of used machinery are below those during the early part of last year.

New York

Machinery and machine tool dealers in the New York district report that business has remained steady for the past two weeks and that, while it is not nearly up to expectations, it is not as bad as is generally supposed. Railroads are buying single tools and there are several lists out. The Long Island, the New York Central, the Pennsylvania and some Southern roads are inquiring and it is expected that some of the items will be closed this week.

Automobile builders are again buying and, according to reports, a good steady business may be expected from this source. New England textile mills have not been purchasing, but reports coming from the South show that the mills in that section are in the market for machinery.

Japanese orders have been coming in lately and efforts are being made to cement a business relation with that country at the present time despite the disputes on exclusion.

Dealers in used tools report an active market and exporters also seem satisfied with the volume of business being done at this season.

Cleveland

As far as actual orders or new business are concerned, the month of April closes much as it started with machinery and tool factors in the Cleveland district. While there has been a marked increase in the number of inquiries for equipment of nearly every description, actual orders appear to be fewer, and smaller, according to leading producers and distributors, than they were prior to April 1. The reason advanced for this, general manufacturers report, is that there is no certainty for increased outlet for added production at this time.

At the moment the chief aid to the machine tool trade can be expected from two sources—the railroads and the automobile industry. The caution manifested by the latter at the beginning of the year now is reflected by increased demands for small equipment.

Heavy duty equipment is lagging, though this is the subject of considerable inquiry that should have developed actual business before this.

Much is expected by all machinery interests in this district from the proposed improvements by railroads. In fact the inquiries from the railroads, and rail equipment workers, appear to make up the bulk of the lists now pending. Two outstanding improvement projects that interest the Cleveland market particularly are those by the Roanoke and Western and the Chesapeake and Ohio, the latter especially since it has indicated it will increase by several thousand its car and other rolling equipment.

Detroit

Indications are that automobile production will show an increase with the arrival of a late spring.

For several weeks past the uncertainty that has apparently gripped executives in many quarters had a reaction in machinery lines that was anything but helpful. Everything points to high production for the next few months, at least by the big manufacturers.

Several very far-reaching announcements in the motor field may be expected at any time, it is reported on good authority, and there are rumors that several large orders for machinery are imminent.

How Michigan is keeping pace with Detroit whose employment figures, considered always an index to business conditions, are the highest in history is shown by a survey just conducted by the Michigan Manufacturers' Association. John L. Lovett, general manager, said:

"Reports from all the industrial centers of the state indicate a greater employment than heretofore recorded. Flint reached the peak in March of 33,000 men. . . . Reports from Grand Rapids indicate that 5,000 more men are employed there than ever before. The same condition holds true of Battle Creek and Jackson. Wages are high. There is nothing in the business situation to indicate that there will not be a steady employment and steady production during the summer months."

Smaller manufacturers are directing numerous inquiries to Detroit offices with an idea of increasing efficiency of operation. This is especially true of the canning factories which will open later in the year, it is reported.

Railroads of the state are holding off extensive improvements that have been

promised until they are certain that Congress does not interfere with the transportation system. An early adjournment will go far towards bringing about greater activity in the railroad field.

Philadelphia

A general curtailment of production in virtually all industrial lines was noted this week throughout the Philadelphia district. In spite of this fact the records show a negligible amount of unemployment, this condition having been brought about through shortening of hours rather than meeting the situation by reducing forces.

In some lines there was less curtailment than in others, although but few industries escaped a cut in their output. The production of motor trucks, some leading manufacturers asserted, is one line that is now virtually equal to the production of this time a year ago. The first quarter of 1924, manufacturers said, will be about equal in truck production with the corresponding period of 1923.

There appeared to be little or no change in the machine tool production in the last two weeks. This view is supported by *Bradstreet's Review*, which sees little in the outlook for the immediate future in the general machinery line.

There was nothing to indicate to many manufacturers that railroads will enter the field as extensive buyers in the machinery line. Some rather large expenditures are contemplated for terminal improvements, however.

The Pennsylvania State Employment Agency reported that in foundries and machine shops throughout the state there is an increase of about 3 per cent in employment. Car repair shops, however, showed a slight decrease.

Business Items

Announcement has been made by the Oilgear Co. of Milwaukee, Wis., of the appointment of Henry Prentiss & Co. as its exclusive agents in the New England states, New York state, northern New Jersey and northeastern Pennsylvania.

The Smith-Heylandt Co., Minneapolis, Minn., has recently been formed to engage in the manufacture and sale of the Heylandt apparatus for making oxygen and other gases.

The Chicago office of the Max Ams Machine Co., 20 East Jackson Boulevard, will be moved May 1 to 310 South Michigan Boulevard.

The Multiple Offset Machine Co., Baltimore, Md., has recently been absorbed by the American Machine & Foundry Co., Brooklyn, N. Y., which will have the sole right to manufacture, sell and service the machine formerly produced by the Multiple Offset Machine Co.

The plant and offices of the Wilson Welder & Metals Co., 132 King St., New York City, will be moved May 1 to the Wilson Building, Hoboken Factory Terminal, Hoboken, N. J.

Announcement has been made of the formation of the Collins Manufacturing Co. with factories in Detroit by the consolidation of the automotive division of the Q. & C. Co., the Advance Aluminum Die Casting Co., and the Collins Stamping & Manufacturing Co. The new organization will manufacture a line of automobile hardware, selling only to the manufacturing branch of the industry. Factory and sales headquarters will be located at 3924 Fort St. W., Detroit. Main offices of the company will be at 90 West St., New York City. Officers of the new company are C. F. Quincy, chairman of the Board; J. R. Collins, president and in charge of sales; Dorr Miller, vice-president in charge of operations, and F. F. Kister, secretary and treasurer.

The Oxford Foundry & Machine Co., Ltd., Oxford, Nova Scotia, has not wasted time in repairing the damages done to its plant by fire recently. A new machine shop and erecting room now being built will be an improvement on the old one as all erecting and machine work will be done on the same floor.

The name of the Indianapolis Pressed Steel Co. has been changed to the Indiana Pressed Steel Co. and the location of the main office transferred from Indianapolis to Muncie, Ind.

The Bolton Co., 261 Franklin St., Boston, Mass., is now the New England representative for the Consolidated Tool Works, 296 Broadway, New York City.

The American Locomotive Co. has received an order from the Chesapeake & Ohio R.R. for fifty 157-ton and fifty 180-ton mikado engines. Approximately $6,600,000 is involved in the order.

The American Car & Foundry Co. has acquired a substantial interest in the Pacific Car & Foundry Co., with plants at Seattle and Portland, Ore.

The Stoughton Wagon Co., Stoughton, Wis., which now devotes practically its entire capacity to the production of motor trucks, motorbusses, etc., has purchased the motor truck engine department of the Mid-West Engine Co., Indianapolis, and is transferring the equipment to its works at Stoughton.

The Austin-Western Road Machinery Co., of Atlanta, Ga., has leased a new building now under construction at 351 Whitehall St., and will occupy the building about June 1 as a warehouse and general offices for the southern territory.

Obituaries

EDWIN C. SPEAR, treasurer and manager of the Cheney Bigelow Wire Works and treasurer of the Hampden Brass Co. of Springfield, Mass., and a director in the American Metallic Fabric Co. of South Yarmouth, Mass., died in his home in Springfield, recently, at the age of 68 years. He began his connection with Cheney Bigelow in 1884 as bookkeeper and paymaster and became treasurer and general manager in 1898. He was a 33d degree Mason. He was a native of Chester, Mass., and passed his early years in Easthampton and Holyoke.

HENRY KNIPPENBERG, 81 years old, a pioneer resident of Indianapolis, and for several years a partner of E. C. Atkins, founder of E. C. Atkins & Co., saw manufacturers, died April 17 in New Jersey.

FRED EDSON MUZZY, former vice-president of the J. Stevens Arms & Tool Co. of Chicopee Falls, Mass., died in his home in Springfield, Mass., April 23, of cerebral apoplexy.

Personals

DANIEL H. PARKER, for the past twenty years connected with the Windsor, Vt., division of the National Acme Co. and its predecessor, has been appointed general manager of the Windsor plant to succeed NEAL W. FOSTER, who goes to the Cleveland office of the company as general manager. EDWIN C. HENN, son of A. W. Henn, president of the company, will succeed Mr. Parker as office manager.

IRA D. GROVE, formerly sales representative for the Landis Tool Co. in the Cleveland and Detroit territory, has been appointed sales manager of the Lees-Bradner Co., Cleveland, Ohio. He succeeds GLEN MUFFLY who is opening an office in Chicago as consultant on merchandising of automotive and mechanical products.

PROF. ELIHU THOMSON, one of the founders of the General Electric Co., sailed April 26 on the Comte Verdi for a three months' tour of European countries. While abroad, he will receive the Lord Kelvin gold medal, which was recently awarded to him. The presentation will be made early in June at London, England.

MARTIN J. LUTHER has been appointed by the Kearney & Trecker Corp., Milwaukee, Wis., as Chicago sales representative associated with R. W. OTT. Mr. Luther was formerly with the Foster Machine Co. and the Warner & Swasey Manufacturing Co., in the Chicago territory.

J. W. BLACKFORD has joined the personal staff of Thomas A. Edison, Orange, N. J. Mr. Blackford was formerly connected with the Dale Machinery Co., New York and the Consolidated Machine Tool Corp., of America.

MILES E. STANDISH will have charge of the newly opened branch office in Chicago of the Burke Electric Co., Erie, Pa. His headquarters will be at 310 S. Michigan Ave.

L. A. MARSHALL, for several years service manager of the Industrial Works, Bay City, Mich., is now connected with the Chicago office of the same company, located at 1051 McCormick Building.

CHARLES A. COFFIN, former president of the General Electric Co. and now honorary chairman of the board, was awarded a certificate of honorary membership in the Franklin Institute on April 16th at Philadelphia.

R. J. LAWELL, vice-president of the George M. Diehl Machine Works at Wabash, Ind., has returned from a visit with factory representatives in Buffalo and Jamestown, N. Y.

A. CHARLES WAGHORNE, formerly sales engineer at the home office of the Palmer Steel Co., Springfield, Mass., has opened an office in Boston for the company.

B. J. FLANIGAN, treasurer and San Francisco manager of the Herberts Machinery & Supply Co., has been on an extended Eastern trip visiting various factories which his company represents on the Pacific Coast.

HARRY J. SWANSON is receiving the sympathy of his friends because of the death of his wife recently. Mr. Swanson is the sales manager of the Peerless Machine Co., Racine, Wis.

BRIG. GEN. HARRY TAYLOR is to be the next Chief of Engineers of the U. S. Army. COL. EDGAR JADWIN will succeed Gen. Taylor as Assistant Chief of Engineers. An announcement to the foregoing effect was made by the Secretary of War on April 23. Major General Lansing H. Beach, the present Chief of Engineers reaches the retirement age on June 18, when he will be succeeded by Gen. Taylor.

CHARLES F. and PRINCE DEBARDELBEN until recently of the Alabama Fuel & Iron Co., Birmingham, Ala., have acquired the interest of J. A. MCCARTNEY in the Charles C. Steward Machine Co., Birmingham, and will become active in the management of that company.

MAJ. EARL MCFARLAND, stationed at the U. S. Armory in Springfield, Mass. for the past four years, and commandant since Aug. 1, 1923, has been appointed professor of ordnance and gunnery and head of that department, to take effect July 1.

E. W. ALLEN, formerly engineer and assistant manager of the central district of the General Electric Co. with headquarters in Chicago, has been appointed manager of the engineering department of that company.

F. J. LANE, who for some time has been in charge of the Detroit sales offices of the Allyne-Zerk Co., manufacturer of the Allyne-Zerk lubricating system, has been elected vice-president in charge of sales. E. V. HARKINS was elected treasurer, succeeding F. W. FORD, who recently became general manager.

CARL H. L. FLINTERMANN, HENRY LOCKHART, JR., and associates, have formed the Flintlock Corp., to take over the Carson Manufacturing Co. and to manufacture a type of radiator core which the Carson Co. has been developing. It is the plan of the new company to build a manufacturing plant somewhere in the Detroit district.

BERT MCBRIDE, receiver for the Millholland Machine Co. of Indianapolis, has announced that the assets of the company will be sold at private sale May 14. Included in the assets are all the patent rights of the company and all tools, machinery, raw and finished materials.

GORDON M. EVANS, until recently superintendent of planning of the Maxwell Motor Corp., of Detroit, has been appointed assistant to the president of the Edward G. Budd Manufacturing Co. of Philadelphia.

JOHN A. ROSE, manager of the export sales department of the Nash Motors Co., Detroit, has resigned to engage in an undertaking he has had under consideration for some time, but details of which are not yet ready for announcement. Mr. Rose has had charge of export sales for Nash Motors and its predecessor, the Thomas B. Jeffery Co. since 1915.

Industrial Physicians Hold Meeting

The nation-wide work of reclaiming "the human scrapheap in industry," as well as safety measures looking toward greater efficiency and personal welfare in the nation's factories, were the principal topics discussed at the convention in New York on April 4 and 5 of the Conference Board of Physicians in Industry. More than 100 plant physicians and other industrial and medical authorities from many states were present when the sessions convened with a luncheon at the Hotel Astor. The program had been designed to express not only the best current thought in the work of the Conference Board of Physicians in Industry, but also to celebrate the tenth anniversary of its organization.

Trade Catalogs

Railway Maintenance Service. The R. K. Le Blond Machine Tool Co., Cincinnati, Ohio. Lathes used in railroad shops and other places where heavy duty lathes are needed are described and illustrated in this exceptional booklet that has just been published. The products of this company are shown at work as well as in detail.

Shapers. Gould & Eberhardt, Newark, N. J. Instructions for setting up shapers made by this firm are contained in a four page folder. A diagram of the machine and a table of dimensions are also printed.

Leather Belting. The Chicago Belting Co., Chicago, Ill. This folder shows the products of the company in various forms and sets forth the virtues to be found.

Induction Motors. The Century Electric Co., St. Louis, Mo. A four-page folder describing the Type "SC" squirrel cage induction motors.

Shop-Chart. The American Metals Corp., Brooklyn, N. Y. This chart is being distributed to machine shops where bushing bronze is used. It is handy and useful and should prove a time saver in many shops.

Rotary Pumps. The Lammert & Mann Co., 215-221 N. Wood St., Chicago, Ill. The different types of dry vacuum and pressure pumps made by this company are illustrated and described. Specifications are also stated in the booklet.

Broaching and Assembling Presses. The Oilgear Co., 398 to 408 Thirty-Eighth St., Milwaukee, Wis. Loose leaf bulletins have been issued by this company describing many of its products among them the broaching and assembling presses. A halftone illustration shows the press and specifications give the minute detail.

Air Operated Devices. The Logansport Machine Co., Logansport, Ind. This catalog contains a complete listing, description and illustrations of the various products made by the company. Milling machine fixtures, chucking equipment and other machine tools are enumerated.

High Precision Locating and Jig Boring Machines. Société Genevoise D'Instruments De Physique. Geneva, Switzerland. The R. Y. Ferner Co., 1410 H St., N. W. Washington, D. C., American representative. This booklet sets forth the general use of this machine and its advantages in manufacturing.

Pamphlets Received

Why I Favor the Mellon Tax Plan. By Otto H. Kahn. Distributed by the Citizens National Committee in Support of the Mellon Tax Reduction Proposal. Hotel Biltmore, New York City. In this booklet is set forth Mr. Kahn's ideas on the proposed tax reduction plan.

Stress Analysis of the Model W-1 Engine. Prepared by H. Camines and C. W. Iseler. Government Printing Office, Washington, D. C. This is an Air Service Information Circular and contains many tables, charts, graphs and data on the above mentioned subject.

Comparison Tests of Storage Preparations for Aviation Engine Storage of Less than Six Months. Prepared by S. A. Christiansen. Government Printing Office, Washington, D. C. Halftone illustrations and recommendations on storage are contained in this Air Service Information Circular.

Forthcoming Meetings

Society of Industrial Engineers. Eleventh annual convention. Buffalo, N. Y. April 30, May 1 and 2. Headquarters, 608 S. Dearborn St., Chicago, George C. Dent, executive secretary.

American Society of Mechanical Engineers. Spring meeting. Cleveland, Ohio. May 26, 27, 28 and 29. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Southern Supply & Machinery Dealers Association, National Supply & Machinery Dealers Association, and American Supply & Machinery Manufacturers Association. Triple convention, May 19, 20 and 21, 1924, Hotel Cleveland, Cleveland, Ohio. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

National Association of Purchasing Agents. Annual Convention, Mechanics Hall, Boston, May 20, 21, 22 and 23. W. L. Chandler, secretary, 19 Park Place, New York City.

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

The General Committee of Division V, Mechanical of the American Railway Association. Convention and exhibits. Atlantic City, June 11-18, 1924. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

Railway Supply Manufacturers Association. Exhibit. Atlantic City, June 11-18, 1924.

American Society for Testing Materials. Twenty-seventh annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Week of June 23. C. L. Warwick, secretary-treasurer 1315 Spruce St. Philadelphia, Pa.

American Society for Steel Treating. Sixth Convention, Boston, Mass., Sept. 22, 23, 24, 25 and 26. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Foundrymen's Association. Twenty-eighth annual convention. Milwaukee, Wis. Week of Oct. 13, 1924.

Management Week. Under the auspices of the American Society of Mechanical Engineers. Week of Oct. 20, 1924. New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—There is no large tonnage buying of iron in the current market. Present consumption, however, is in excess of production and large reserve stocks are gradually disappearing. This surplus iron has prevented prices from rising. Steel prices continue to show downward tendencies. Quotations on shapes range from $2.25 to $2.50 per 100 lb., at mill; plates, $2.20 to $2.50 and bars, $2.25 to $2.40. Current buying is mostly for prompt delivery; consumers stocks show need of replenishment. Some large tonnage inquiries are reported mostly for building construction and railroad use.

Non-ferrous Metals.—Copper market improved in tone. Tin down ½c. per lb. in week; lower price did not stimulate purchasing. Small volume of buying in lead market; price down $5 per ton. Zinc business listless; prices rose, however, about ½c. per lb. in New York and St. Louis during week.

(All prices as of Apr. 25.)

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	22@23
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh	New York	Cleveland	Chicago
No. 10	$2.85@3.00	4.34	3.75	4.00
No. 12	2.95@3.10	4.39	3.80	4.05
No. 14	3.05@3.20	4.44	3.85	4.10
No. 16	3.25@3.40	4.54	3.95	4.20
Black				
Nos. 17 and 21	3.70	4.65	4.45	4.55
Nos. 22 and 24	3.75	4.70	4.50	4.55
Nos. 25 and 26	3.80	4.75	4.55	4.60
No. 28	3.85	4.85	4.65	4.70
Galvanized				
Nos. 10 and 11	3.90@4.00	4.90	4.70	4.60
Nos. 12 and 14	4.00@5.10	5.00	4.80	4.70
Nos. 17 and 21	4.30@4.40	5.30	5.10	5.00
Nos. 22 and 24	4.45@4.55	5.45	5.25	5.15
No. 26	4.60@4.70	5.55	5.50	5.30
No. 28	4.90@5.00	5.85	5.80	5.60

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%, less 5%; class A, plus 23%. Cast iron, standard sizes, 34@5% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0,17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
¾	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.70
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	7.40
Floor plates	5.80	5.66	5.80
Cold drawn shafting or screw	4.40	4.10	4.00
Cold drawn flats, squares	4.90	4.60	4.50
Structural shapes (base)	3.59	3.46	3.30
Soft steel bars (base)	3.49	3.36	3.20
Soft steel bar shapes (base)	3.49	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.59	3.46	3.30
Bar iron (3.10@3.15 at mill)	3.49	3.36	3.20
Tool steel	11.00	....	....
Drill rod (from list)	60%	40@55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound			
Copper, electrolytic (up to carlots), New York			14@14.25
Tin, 5-ton lots, New York			49.50
Lead (up to carlots), St. Louis	7.62½	New York	8.25
Zinc (up to carlots), St. Louis	6.12½	New York	6.87½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	27.00	30.00	29.50
Antimony (Chinese), ton spot	11.25	12.00	13.25
Copper sheets, base	21.25	21.50	23.00
Copper wire, base	16.75	19.25	16.25
Copper bars, base	20.50	22.75	19.50
Copper tubing, base	22.75	27.50	23.00
Brass sheets, base	17.75	22.00	18.75
Brass tubing, base	21.50	27.00	20.50
Brass rods, base	15.50	18.00	15.75
Brass wire, base	18.25	22.00	....
Zinc sheets (casks)	10.75	11.00	....
Solder (½ and ½), (case lots)	37.00	34.50	31.50
Babbitt metal (83% tin)	60.00	61.00	52@56
Babbitt metal (35% tin)	28.00	19.50	25@28
Nickel (ingot and shot) f.o.b. refinery	27.00	....	....
Nickel (electrolytic) f.o.b. refinery	30.00	....	35.00
Nickel (F shot) f.o.b. refinery	30.00	....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Shop Materials and Supplies

METALS—Continued

Manganese nickel hot rolled rods "E"—low manganese (base) 54. 00
Manganese nickel hot rolled rods "D"—high manganese (base) 57. 00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32. 00	Hot rolled rods (base)	40. 00
Blocks	32. 00	Cold drawn rods (base)	48. 00
Ingots	38. 00	Hot rolled sheets (base)	42. 00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.25@11. 00	11. 50	11. 25
Copper, heavy, and wire	9. 87½@10. 75	11. 00	10. 50
Copper, light, and bottoms	7. 87½@9. 75	10. 00	9. 50
Lead, heavy	6. 00 @7. 75	7. 00	7. 50
Lead, tea	3. 50 @6. 50	4. 50	6. 50
Brass, heavy, yellow	5. 12½@7. 00		6. 75
Brass, heavy, red	7. 37½@9. 25	10. 00	9. 00
Brass, light	4. 37½@6. 00	6. 00	6. 25
No. 1 yellow brass turnings	4. 37½@7. 00	6. 50	6. 75
Zinc	3. 37½@4. 00	3. 50	3. 75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$24. 30	$22. 85	$18. 50
"A" Grade:				
IC,	20x28, 112 sheets	20. 20	18. 00	17. 00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14. 00	13. 00	14. 50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8. 25	6. 55	7. 40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0. 14@0. 21	$0. 20	$0. 14
Cotton waste, colored, per lb.	. 09@. 12½	. 17	. 10½
Wiping cloths, 13¼x13¼, per lb	11. 75	36. 00 per M	. 16
Wiping cloths, 13¼x20½, per lb.	....	52. 00 per M	. 16
Sal soda, per 100 lb.	2. 40	2. 25	2. 65
Roll sulphur, per 100 lb.	3. 60	3. 50	3. 50
Linseed oil, per gal., 5 bbl. lots	. 95	1. 08	. 94
Lard cutting oil, 25% lard, per gal.	. 55	. 50	. 79*
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	. 29	. 35	. 40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber and duck:			
First grade	50%	50–10%	40–10%
Second grade	50–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5. 40	$5. 84	$6. 48
Emery paper	9. 90	11. 00	8. 80
Emery cloth	31. 12	31. 12	29. 48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1. 49	1. 24	1. 40
Cloth	3. 38	2. 67	3 20
Fire clay, per 100 lb. bag		. 65	. 60
Coke, prompt furnace, Connellsville	per net ton		3. 75@4. 00
Coke, prompt foundry, Connellsville	per net ton		4. 75@5. 50
White lead, dry or in oil	100 lb. kegs		New York, 15. 00
Red lead, dry	100 lb. kegs		New York, 15. 00
Red lead, in oil	100 lb. kegs		New York, 16. 50

*Chicago quotes on pure lard oil, No. 1 grade.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0349	$0.0354	$0.0334
Cold finished shafting	per lb.	0.044	0.044	0.042
Brass rods	per lb	0.155	0.16	0.20
Solder (½ and ½)	per lb.	0.37	0.39	0.335
Cotton waste	per lb.	.14@.21	.14@.21	.10@.13
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.55	0.55	0.60
Machine oil	per gal.	0.29	0.29	0.297
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	45%	45%	30%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	55–5%
1⅛ and 1¼x3 in. up to 12 in	15%	50–5%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	30%	$3. 50 net	.....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	3. 50 net	$4. 00 off
Button head bolts, with hex. nuts	List net	List net	3.50
Hex. head and hex. nut bolts	List net	.....List plus 10%	
Lag screws, coach screws	45%	.....	50–5%
Square and hex. head cap screws	75%	75%	75–5%
Carriage bolts, up to 1 in.x30 in.	35%	05%	50–5%
Bolt ends, with hot pressed nuts	45%	.....	55-5%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, ⅜ and smaller	65%	.....	.....
Semi-finished nuts, ½ and larger	60%	70%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)*	$6. 50	$4. 00	$4. 00
Washers, cast iron, ⅝ in., per 100 lb. (net)	5. 50	4. 00	4. 00
Washers, round plate, per 100 lb. Off list	1. 50	4.00	4. 00
Nuts, hot pressed, sq., per 100 lb. Off list	1. 00	3.50	3. 50
Nuts, hot pressed, hex., per 100 lb. Off list	1. 00	3.50	3. 50
Nuts, cold punched, sq., per 100 lb. Off list	1. 00	3.50	3. 50
Nuts, cold punched, hex., per 100 lb. Off list	1. 00	3.50	3. 50
Rivets:			
Rivets, ⅜ in. dia. and smaller	50%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5. 00	$3.60	$3. 75
Cone heads, ditto (net)	5. 20	3.80	3. 95
1½ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0. 25	.....	0. 15
⅝ in. diameter *EXTRA*	0. 35	.....	0. 15
½ in. diameter *EXTRA*	0. 75	.....	0. 50
1 in. long, and shorter *EXTRA*	0. 75	.....	0. 50
Longer than 5 in. *EXTRA*	0. 50	.....	0. 25
Less than 200 lb. *EXTRA*	0. 50	.....	0. 50
Countersunk heads *EXTRA*	0. 45	.....	$4.20 base

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ala., Birmingham — Dixie Metal Products Co., 1016 28th St., D. D. Bently, Mgr. —equipment for addition to plant for the manufacture of metal products, etc.

Ill., Pittsfield—Elgin Engine Turning & Mfg. Co.—one 16 in. back geared shaper and one 100 lb. automatic drop hammer.

Ind., Muncie—Amer. Lawn Mower Co., 18th and Monroe Sts.—machinery.

Ky., Bowling Green—E. B. Crump, 1144 State St.—rolls, crushers, belt conveyor, etc., for rock asphalt crushing plant.

Ky., Louisville—Office of United States Engineer, P. O. Box 72—one wood saw rig with engine, f.o.b. Uniontown; one bending roll for 1¼ in. iron, rolls about 5½ in. diameter, 62 ft. long for Dam 46, Ownesboro.

Md., Baltimore—Bd. of Awards, City Hall—receiving bids until May 7, for one air operated tool forming and sharpening machine with air compressor, furnace and accessories, for water department.

Mass., Westfield—Westfield Boys Trade School—receiving bids until May 8 for one engine lathe.

Mich., Detroit—Carey Co., 6197 Hamilton Ave.—complete equipment for sheet metal roofing shop.

Mo., St. Louis—Semi-Steel Casting Co., 209 East Quincy St.—air compressor, 6 x 8 twin cylinder, or double acting, for foundry.

N. Y., Buffalo—Polson Mfg. Co., 1750 Main St.—42 in. squaring shears.

N. Y., Fayetteville—Precision Castings Co., Inc., F. W. Searle, Purch. Agt.—pipe threading and cutting machinery, also tapping machinery, gear and milling cutters.

N. Y., Fayetteville—L. and J. S. Stickley, Inc. (manufacturer of furniture), A. Armine, Purch. Agt.—woodworking and sawing machinery, also belting and gear cutters.

N. Y., Fort Plain—Square Deal Garage, Hancock St., E. Staley, Purch. Agt.—bench lathe and drill press for motor repair.

N. Y., New York—Foundation Co., 122 West Liberty St.—10 ton, 68 ft. span overhead crane for Southern Ry. shops at Knoxville, Tenn.

N. Y., Troy—Unity Brush Shop, 803 4th Ave., North, H. F. Inskip, proprietor—one sanding machine with wheels, 8 x 8 in., for white birch wood blocks.

O., Columbus — Brunt Porcelain Co., Chaseland (manufacturer of floor tile), G. H. Brunt, Purch. Agt.—grinder, large press and other equipment.

O., Columbus—Buckeye Mill & Lumber Co., 640 North Jefferson Ave., E. McElravey, Mgr.—sash and door sticker, also Universal woodworker.

O., Columbus—Palace Garage, 751 East Long St., H. L. Karus, Purch. Agt.—grinder, drilling machine and air compressor, small size.

O., Columbus—C. H. Weeden, 1295 North 4th St. (manufacturer of enamel)—medium grinder and large furnace, 600 lb. capacity.

Pa., Muncy—Sprout, Waldron & Co.—angle iron cutting machine, capacity 4 x 3 x 3 in. angles.

Pa., Phila.—Agnew, Batteiger & Co. (Iron), 1642 Widener Bldg., R. L. Batteiger, Vice Pres.—shear knife grinder for yard at Coatesville.

Pa., South Greensburg (Greensburg P. O.)—Railway & Industrial Eng. Co.—drill press, riveting machine, shears, copper crucible, hooks and overhead crane.

S. C., Greenville — Greenville Steel & Fdry. Co., Markley St., address E. McCrady—equipment for plant for the manufacture of structural and machinery castings, also for fabricated structural steel.

Tex., Waco—W. Cameron & Co., 8th and Mary Sts.—small portable shears for cutting reinforcing iron up to 1 in.

Wis., Exeland — Sta-Tite Handle Mfg. Co. (manufacturer of hammer and axe handles), M. Nicholls, Purch. Agt.—wood turning lathes and sander.

What This Section Is

Machinery Requirements and Industrial Construction is a reliable machinery market, because every item is reported first-hand by our own correspondents, scattered over the United States and Canada. These leads are verified by our men. We do not use newspaper clippings, nor do we listen to any hearsay or rumors. These sales leads are as accurate as our men can make them, and as timely as weekly publication will permit.

This market is for *American Machinist* subscribers. It covers the same machinery fields as does the paper. Here will be found inquiries for machine tools, presses, hammers, welding, forging and heat treating equipment, wood working machinery, cranes, hoists and other material handling machinery for the shop.

Here also will be found reports of proposed industrial construction, where sooner or later machinery will be needed.

Are you making the most of the opportunities listed here?

Wis., Milwaukee — Unger Pulp & Fibre Products Co., 509 2nd Ave., M. Unger, Purch. Agt.—fibre board sawing machines and creasers.

Wis., Oconto—Oconto County, E. W. McAllister, Highway Comr.—lathe, drill press, miller and grinder for small machine shop to repair road equipment.

Ont., Cooksville—Turners Garage—complete equipment for proposed $40,000 garage and automobile repair shop.

Ont., New Liskeard—Shepherdson & Son —equipment for planing mill, to replace that which was destroyed by fire.

Ont., Orillia—J. R. Eaton & Sons, Ltd. (sash and door factory), W. M. Tupling, Secy.—knives, saws, sticker, etc.

Opportunities for Future Business

Ala., Birmingham — The Dixie Metal Products Co., 1016 28th St., is building an additon to its plant on a 50 x 125 ft. site. D. D. Bently, Mgr.

Calif., Los Angeles — The Willys-Overland Pacific Co., 1058 South Hope St. plans to build an automobile testing and assembling plant, to contain 100,000 sq.ft. of floor space.

Calif., San Francisco—The Amer. Steel & Wire Co., 16th and Folsom Sts., had plans prepared for the construction of a 2 story factory. Estimated cost $40,000. Private plans.

Calif., San Francisco—The Kleiber Motor Truck Co., 11th and Folsom Sts., awarded the contract for the construction of a 2 story automobile building shop on 10th and Folsom Sts. Estimated cost $165,000. Noted Mar. 6.

Ill., Chicago—The Graff Motor Coach Co., c/o Oman & Lilienthal, Archts., 64 West Randolph St., awarded the contract for the construction of a 3 story, 74 x 144 ft. automobile body factory on Michigan and 37th Sts. Estimated cost $150,000.

Ind., Crown Point—The Cummings Vote Register Co., Knox, plans to build a plant for the manufacture of voting machines, here. Estimated cost $40,000.

Ind., Muncie—The Amer. Lawn Mower Co., 18th and Monroe Sts., plans to build a 50 x 180 ft. addition to its factory.

Mass., Boston—The Y. D. Service Garage Inc., 341 Newbury St. is having plans prepared for the construction of a service and repair station at 18-20 Deerfield St. Estimated cost $200,000. J. S. Corbine, Pres. Private plans.

Mass., Cambridge—The Genl. Redio Co., 11 Windsor St., awarded the contract for the construction of a 3 story, 50 x 95 ft. plant. Noted Mar. 27.

Mass., Westfield—The Amer. Abrasive Co., Union St., is having plans prepared for the construction of 3 story, 40 x 90 ft., 1 story, 50 x 185 ft. and 2 story, 50 x 62 ft. factory units, etc. M. B. Harding, 97 Elm St., Archts.

N. Y., New York—The Alumor Realty Co., c/o C. N. Whinston & Bro., Archts., 2 Columbus Circle, is having plans prepared for the construction of a 7 story, 75 x 100 ft. garage at 195 Washington St. Estimated cost $200,000.

N. C., Spencer—The Southern R.R. Co., 13th St. and Pennsylvania Ave., Wash., D. C., awarded the contract for the construction of a roundhouse, also 51 x 155 ft. flue shop, here. Estimated cost $260,000. Noted Apr. 10.

O., Cleveland — The Cleveland Chain & Mfg. Co., c/o L. B. Round, Pres., Stop 3. A. B. C. Line, awarded the contract for the construction of a 1 story, 170 x 210 ft. factory. Estimated cost $100,000. Noted Apr. 17.

O., Toledo—The city awarded the contract for the construction of a 3 story, 100 x 141 ft. garage on St. Clair St. Estimated cost $150,000. Noted Feb. 21.

Pa., South Greensburg (Greensburg P. O.)—The Railway & Industrial Eng. Co. will build a 2 story, 68 x 220 ft. plant.

Va., Grundy—The Mountain Industrial Institute is having plans prepared for the construction of a machine shop, etc. Cost will exceed $100,000. Mahood & Van Dusen, Bluefield, Archts.

W. Va., Huntington—The International Nickel Co., 67 Wall St., New York, awarded the contract for the construction of a 1 story, 90 x 100 ft. addition to its plant here.